SA waterbulletin

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WATERGEHALTE
Mutagenisiteit in drinkwater – geen risiko vir gesondheid

GROUND WATER
Researchers compile new sediment yield map for SA

SANITATION
New decision support system to aid appropriate selection for developing communities

WATERBEHANDELING
SA Ontwerpgids vir opgeloste lugflottasie beskikbaar

FAKULTEIT NATUURWETENSKAPPE
TECHNIKON PRETORIA

Departement Waterversorging

KORTKURSUSSE 1993

❑ Wateranalisedataverwerking

November 1 - 5 Koste: R500

Die kursus behels monsterneming, statistiese verwerking van analise, kwaliteitskontrole, interpretasie van data versamel vanaf drinkwatersuiweringswerke, biologiese filters, geaktiveerde slyk, nutriëntverwydering en anaerobiese vertering.

Sluitingsdatum: 15 Oktober 1993

❑ Fosfaatverwydering uit afvalwater

November 15 - 19 Koste: R500

Die kursus behels die teorie en bedryf van chemiese en biologiese prosesse asook slykhantering.

Sluitingsdatum: 29 Oktober 1993

❑ Chemiese Wateranalise

November 22 - 26 Koste R1 000

Die kursus dek inleidende laboratoriumtegnieke, monsterneming, dataverwerking, chemiese berekeninge, analitiese prosedures, gravimetrie, titrimetrie, elektroanalise, spektrofotometrie, atoomabsorpsie- en emissiespektrometrie, chromatografie, distilleringsprosedures en praktiese werk.

Sluitingsdatum: 5 November 1993

Die meeste kursusse is ontwerp vir persone met of sonder enige vorige opleiding in die tegnieke. Omdat basiese sowel as gespesialiseerde aspekte in beide die teorie en praktiese opleiding aandag sal geniet, sal die kursusganger met baie meer selfvertroue en inisiatief die kursus verlaat.

Let wel:

- ❑ 'n Volledige stel lesings asook 'n praktiese handleiding, waar van toepassing, word in enigeen van die twee landstale voorsien.
- ❑ 'n Maksimum aantal kandidate kan per kursus geakkomodeer word. Die aansoeke vir elke kursus wat eerste ontvang word, sal voorkeur geniet. "n Minimum aantal deelnemers word ook benodig voordat 'n kursus aangebied sal word.
- ❑ Beide amptelike tale sal gebruik word vir die aanbieding van die kursusse.
- ❑ 'n Eksamen sal aan die einde van elke kursus afgeneem word. Punte sal ook vir praktiese werk toegeken word, waar van toepassing. Amptelike sertifikate sal slegs aan kandidate uitgereik word wat die teoretiese en praktiese gedeeltes slaag. Kandidate wat nie slaag nie, ontvang slegs 'n bywoningsertifikaat.

Inligting en besprekings

Die Hoof: Departement Waterversorging, Skool vir Natuurwetenskappe, Technikon Pretoria, Privaatsak X680, Pretoria 0001

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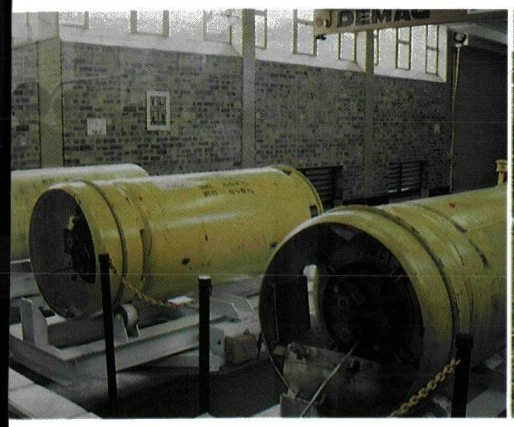

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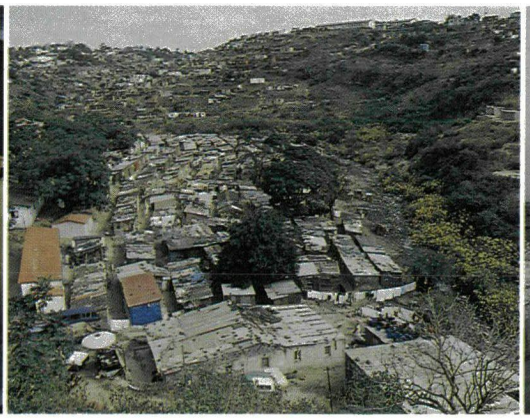

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SYMPOSIUM: HYDROLOGISTS MEET IN 'MARITZBURG

"The need for cooperation and common purpose with regard to water and water resources in Southern Africa is very clear indeed and it is thus very gratifying to see the increasing interaction between scientists in sub-Saharan Africa." This was said by Professor Maughan-Brown, Vice-Principal of the University of Natal (Pietermaritzburg) when he recently opened the sixth South African National Hydrological Symposium, held in Pietermaritzburg.

The symposium was hosted and organised by the Department of Agricultural Engineering, University of Natal, and the Computing Centre for Water Research (CCWR), under the auspices of Sanciahs.

More than 200 delegates attended the two day symposium. A number of delegates came from neighbouring and foreign countries as far afield as Ghana and Kenya.

In his opening address Prof DA Maughan-Brown noted the multi-disciplinary nature of hydrology saying that it would be difficult to find a more striking example of multi-disciplinary expertise coming together to focus on an area of common concern.

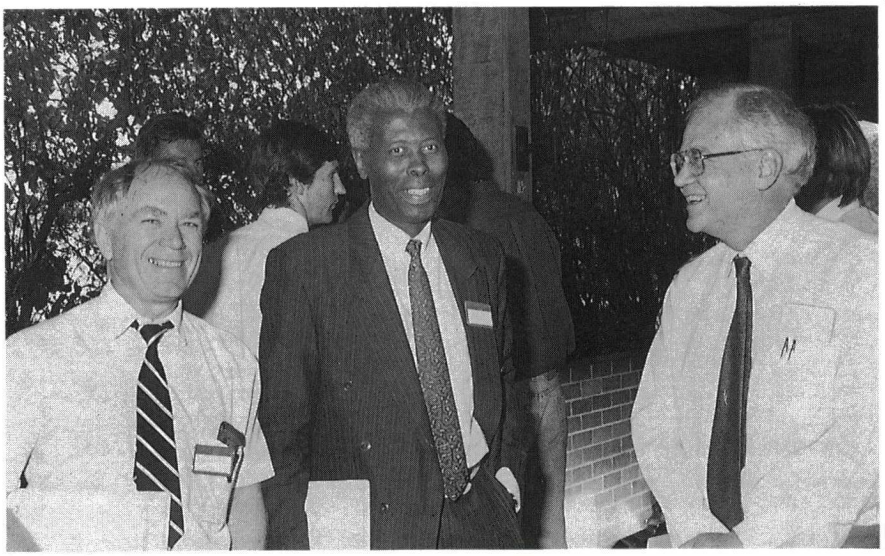
Professor Maughan-Brown gave a special word of welcome to Mr Piet Odendaal, the Executive Director of the Water Research Commission (WRC), saying that many of the South African scientists present at this symposium owed their research funding to the WRC.

KEYNOTE SPEAKERS

The two keynote speakers were Dr Jim Wallis from IBM Research Division, New York, USA and Professor Hubert Morel-Seytoux from the Stanford University, California, USA.

Dr Jim Wallis is a renowned hydrologist and IBM research fellow. It was his vision and support that eventually led to the establishment of the Computing Centre

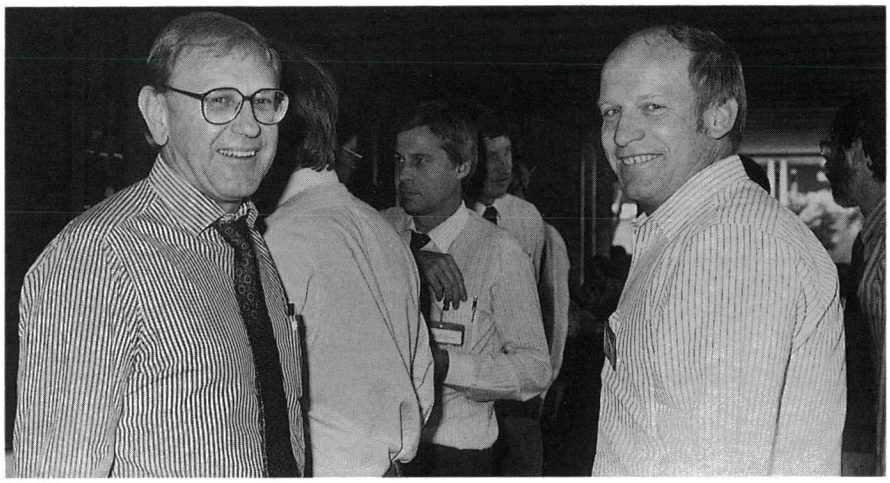
The organisers with the keynote speakers at the Hydrological Symposium: (from left) Dr Simon Lorentz (Dept. Agricultural Engineering, University of Natal), Prof Hubert Morel-Seytoux (Stanford University, USA) Hugo Maaren (Water Research Commission), Dr Jim Wallis (IBM, USA), Dr Mark Dent (Computing Centre for Water Research).



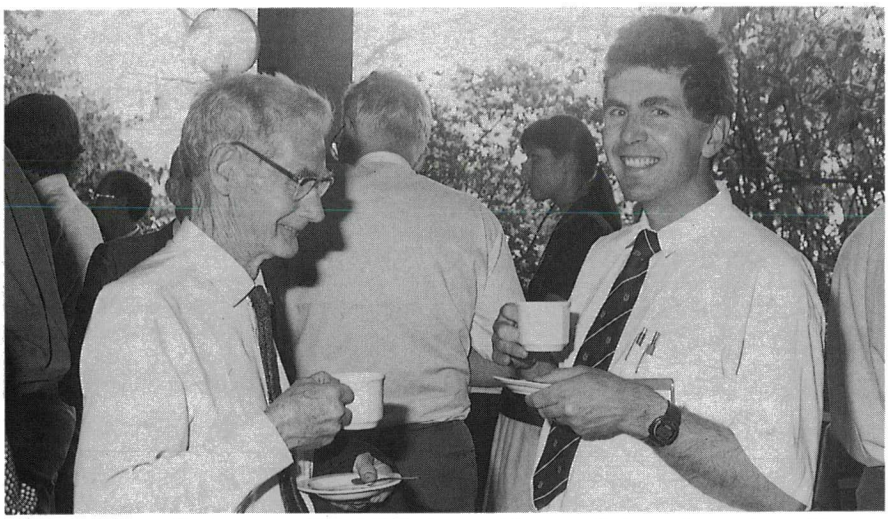
(From left) Mr Brian Gardener (CSIR) and Dr Phila Ndlovu (University of Natal) in conversation with Mr Arne Kure (CCWR).

for Water Research (CCWR) at the University of Natal (Pietermaritzburg).

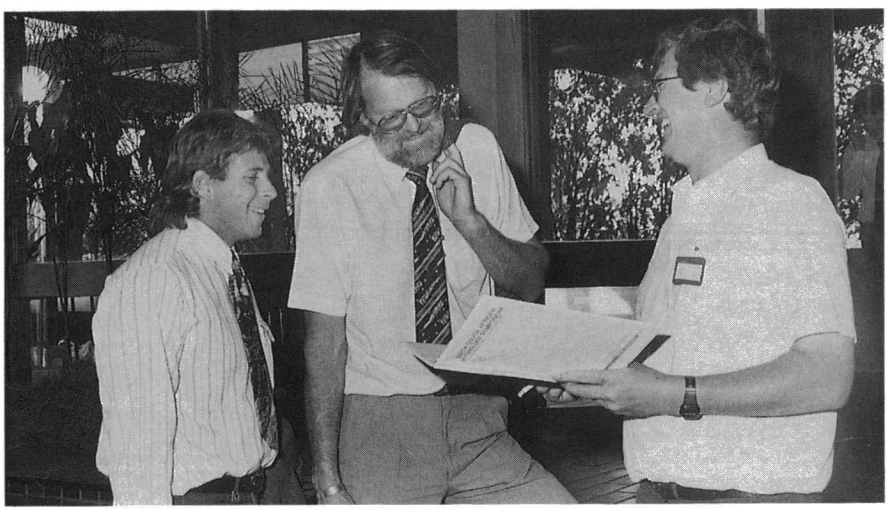
Dr Wallis in his paper titled "Water Resources approaching the millenium", said that population and regulatory pressures, political and economic instabilities, and climatic changes can all be expected to further stress water supply resources in future. To offset these negative pressures the water resource planner will have to rely more and more on sophisticated technology - in particular computer networks, large cheap, easy to access data bases, decision support systems, object oriented programming and other user friendly computer programmes.



Prof Roland Schulze (Dept Agricultural Engineering, University of Natal) and Mr Brian Hollingworth (Development Bank of Southern Africa) gave the SA Waterbulletin broad smiles at the symposium.



Prof David Tarboton and Mr GS Tarboton, his grandfather who sat in on his grandson's paper at the symposium, having a cup of tea together. Prof Tarboton is an old Natalian now doing research and lecturing at Utah State University, USA.



(From left) Mr André Mostert (Dept. Water Affairs, Namibia), Mr Charel Bruwer (Environment Studies, Dept. Water Affairs) and Dr Stefan de Wet (SARCCUS, Namibia) having a light moment in their discussion of the symposium papers.

Professor Morel-Seytoux is a internationally renowned hydrologist specialising in ground water and the conjunctive use of surface and ground water. He has taught surface and groundwater hydrology to a number of South Africans who have studied at Colorado State University. In his keynote address Professor Morel-Seytoux dealt with approaches to modelling the spatial diversity of hydrological processes, with particular reference to rainfall infiltration relationships.

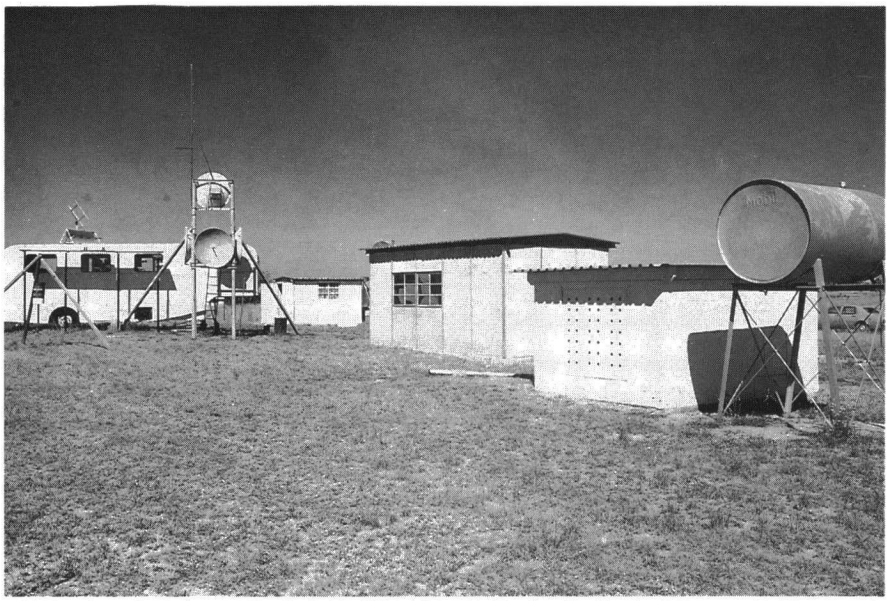
PAPERS

A large number of papers covering a wide range of hydrology related subjects were presented during the three parallel sessions at the symposium. Papers presented were divided into a few broad categories such as water quality hydrology, hydrological processes and modelling, water resources, hydrological meteorology (rainfall), hydrological processes (evaporation), groundwater, forest hydrology, land use classification and water quality, water quality modelling using GIS.

The symposium was concluded with a convivial banquet and two technical tours with Umgeni Water.

Proceedings of the symposium are available from CCWR, University of Natal, PO Box 375, Pietermaritzburg 3200, at R150 per set.

Scientist looks at lightning and its relation to precipitation



Part of the Nietgedacht Radar Station.

The results of a research project in which the relationship between lightning and precipitation was investigated, has been published by the Water Research Commission in the form of a final report.

David E Proctor, from the Division of Earth, Marine and Atmospheric Science and Technology (EMATEK) at the CSIR, carried out the research and found that lightning was definitely affected by precipitation. Unfortunately, he was unable to demonstrate the converse, namely, how precipitation is affected by lightning.

The objectives of the study, according to the report, were as follows:

- To map lightning in relation to three-dimensional precipitation patterns of the host storms and, in particular, to plot the starting points of flashes on radar maps of the storms, to see how lightning is related to precipitation.
- To make some observations in real time, while storms are in progress, to observe where lightning flashes begin.
- To analise recordings of the relative rare positive flashes to ground, and
- To study radar reflections from lightning using radar.

Coalescence is one of the known rainfall mechanisms by which water droplets that are too small to fall, grow to become raindrops.

A British scientist, Lord Rayleigh, demonstrated in 1879 that electrically uncharged water drops do not coalesce when they collide in a region where there is no electric field, whereas collisions that occur in the presence of an electric field usually result in coalescence.

Lord Rayleigh's experiments were repeated in 1969 by workers at the National Centre for Amospheric Research (NCAR) in the United States, who developed special apparatus that caused drops of a constant size to collide in precisely the same position many times in succession. This permitted them to photograph not only the colliding drops, but also to photograph successfully the integrated total light from many very minute electrical discharges that occurred between the drops at the instants just preceding their collisions.

Lord Rayleigh's discovery evokes the question: where do electric fields occur in thunderstorms? The answer, that electric fields are highest near concentrations of charge, leads to enquiries concerning the distribution of charges in thunderstorms.

The researcher says that information about the location of strong electric fields in thunderstorms can be obtained by locating the origins of lightning flashes and by plotting their positions on maps of the thunderstorm. This has, therefore, been one of the main thrusts of this research project in which the emphasis was placed on the relationship between lightning and precipitation, with some effort being devoted to studies of lightning *per se*.

ORIGIN OF LIGHTNING

The origin of a lightning flash is defined as the region where the flash began. The origins of 773 flashes that occurred during 13 thunderstorms were located by measuring the differences between the times at which radio pulses, emitted by the lightning, arrived at five, widely spaced receiver stations on the ground.

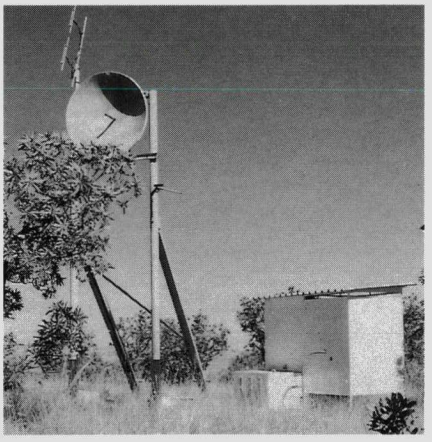
According to the report, it was found that the distribution of flashes' origin heights was bimodal, with peaks at 5,3 and 9,2 km above sea-level. Flashes in the 5,3 km group were more numerous in ten storms, but evidence suggested that this was probably depended on the phase of the storm.

The properties and behaviour of flashes in the 9,2 km group were markedly different from those in the 5,5 km group. However, both discharged negative electricity, as shown by electric field changes recorded by many whose paths were also known.

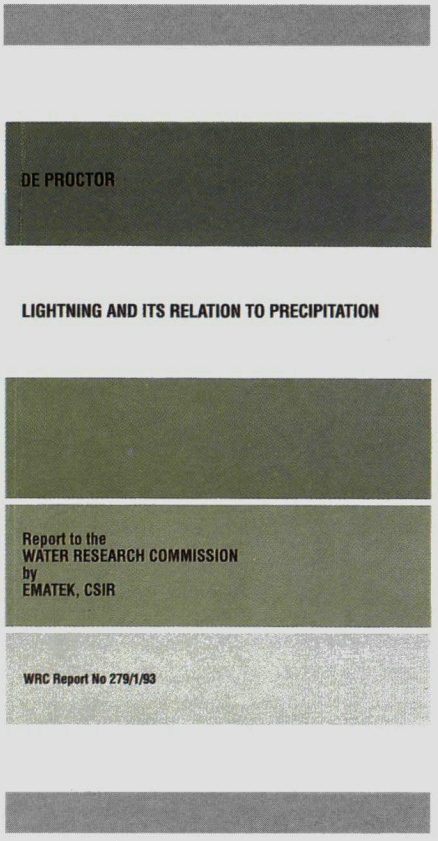
Flash origins tended to cluster in regions that were a few kilometres or less in horizontal diameter. The origins of 658 flashes were mapped onto radar precipitation patterns of their host thunder storms. Eventually, maps were arranged to show contours that marked the positions of surfaces at which the radar reflectivity just exceeded a value of 100 mm per cubic metre. The value 100 is equal to 20 dBZ on the logarithmic scale (dBZ indicates the strength of the radar signal) and these surfaces were therefore designated as S20.

According to the report the researcher found that 66 per cent of the flashes began immeasurably close to the surfaces S20; 27 per cent began inside these surfaces and seven per cent began outside the surfaces S20. Similar results were found for the high flashes, but a greater percentage of the 195 ground-flashes began inside the surfaces S20. The distance between each origin and its nearest S20 surface was also measured. The distribution of these distances showed a marked peak near zero. Lightning is expected to begin in regions where the electric field is highest. The researcher says it is easy to show that, in the case of a uniformly charged volume, the electric field is most intense at the surface and "we inferred that surfaces S20 enclosed regions that were charged". He says there was evidence that the charges had resided on smaller drops that co-existed with larger drops. This evidence, provided by calculations that showed that small droplets provided most of the capacitance (i.e. the facility to store charge) was supported by measurements reported by other scientists elsewhere in the world.

C-Band Radar



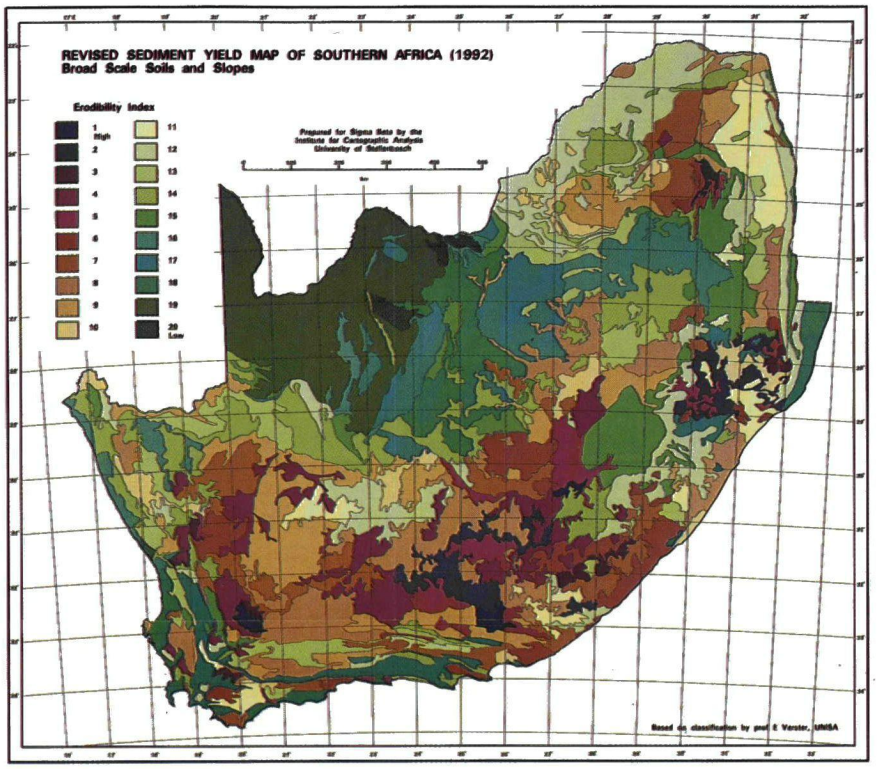
Protea Ridge Remote Radar Station.



Copies of this report entitled "Lightning and its relation to precipitation" (WRC report 279/1/93) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: $25).

Developing a new sediment yield map for southern Africa

A document which deals with the technical aspects concerning the preparation of the new sediment yield map of southern Africa has been published by the Water Research Commission.



Broad scale soils and slopes in southern Africa.

The document is the result of research undertaken during 1990 and 1991, at the request of the Water Research Commission, by A Rooseboom (Sigma Beta Consulting Engineers), E Verster (UNISA), HL Zietsman (University of Stellenbosch) and HH Lotriet (Ninham Shand).

According to the document, information on sediment yield values for southern Africa was derived mainly from reservoir re-surveys performed by the Department of Water Affairs, and also from a number of South African river gauging stations and recorded sediment data for Lesotho, collected by S Makhoalibe, published in 1984.

Many of the existing reservoirs in South Africa have been re-surveyed by the Hydrographic Survey Section of the Department in order to determine the capacity of these reservoirs and the loss of storage capacity due to sedimentation. Sediment values can then be calculated from the observed decrease in reservoir storage volumes.

Using the capabilities available on GIS, maps of various physical and geographical features of southern Africa which influence sediment yields were prepared and placed in GIS. These included:

- A basic erosion index map indicating the basic yield of different regions.
- A land use map based on the value of agricultural products sold in 1975.
- An average slope map depicting the energy gradients for defining sediment transport capacities.
- A rainfall erosivity map based on EI_{30} values (compiled by AA Smithen and RE Schulze in 1982), for a ten year return period.

The researchers say an analysis or calibration of data for southern Africa as a whole is not possible due to the geographical diversity of the sub-continent, and, therefore, they divided the region into nine relatively homogeneous sub-regions.

CALIBRATION

Various methods were used in an attempt to calibrate the new sediment yield map:

- With the aid of multiple linear regression techniques, an attempt was made to link sub-areas with differing yield potential and land-uses to their observed sediment yields. This attempt failed due to the lack of significance of overall model results as well as of individual variables, intercorrelation between independent variables, large standard errors and physically insignificant results.
- A mathematical model developed by Rooseboom in 1992, which describes turbulent transport of sediments through catchments, could also not be calibrated due to the fact that sediment availability rather than transporting capacity proves to be the limiting factor in determining sediment yields in practically all cases.
- Statistical analysis was eventually performed on a regional basis to overcome the wide variability observed in sediment yields. The fun-

damental assumption here was that sediment availability is the determining factor in sediment yield processes across southern Africa. Yield values were standardised for all regions and the log generalised extreme value distribution with a negative skew was found to provide the best fit of the data. The relationship between yield and catchment size was examined. Mean values and confidence bands of sediment yield values showed a strong tendency to converge to a regional mean value with increasing catchment size.

UNGAUGED CATCHMENTS

A method for estimating sediment yields from ungauged catchments based on the results of the statistical analysis is presented, which allows for confidence limits to be affixed to estimated yields from ungauged catchments.

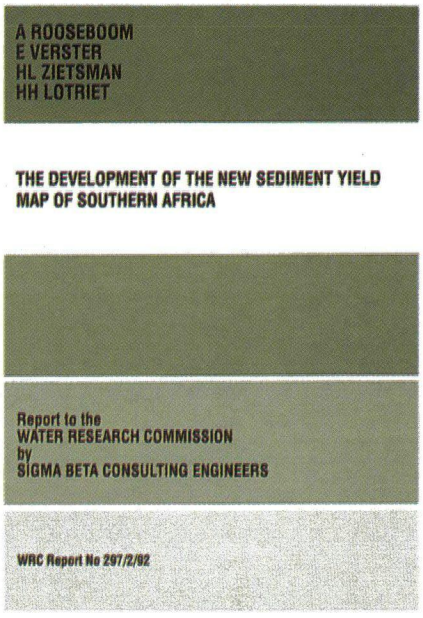
MAPS

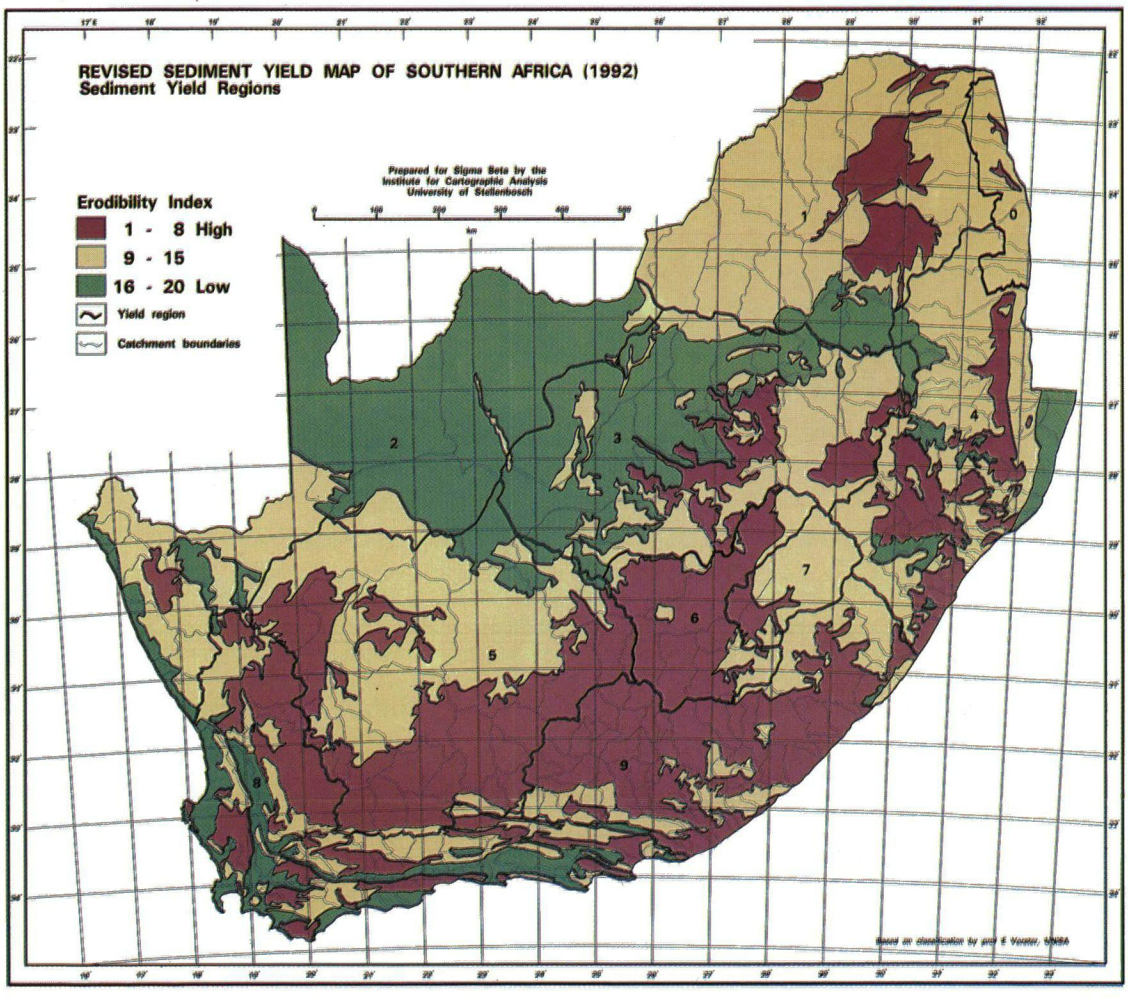
Small scale reproductions of maps developed during the research are included in the publication together with two A3 size, higher quality, larger scale reproductions.

The researchers say it must be stressed that observed sediment yields in southern Africa show a high measure of variability due to the complex interaction of factors influencing sedimentation processes. For this reason, this document should not be used rigidly.

Skilled assessment of conditions in catchments are required where estimates of yields, that might have significant implications, need to be made, the researchers say.

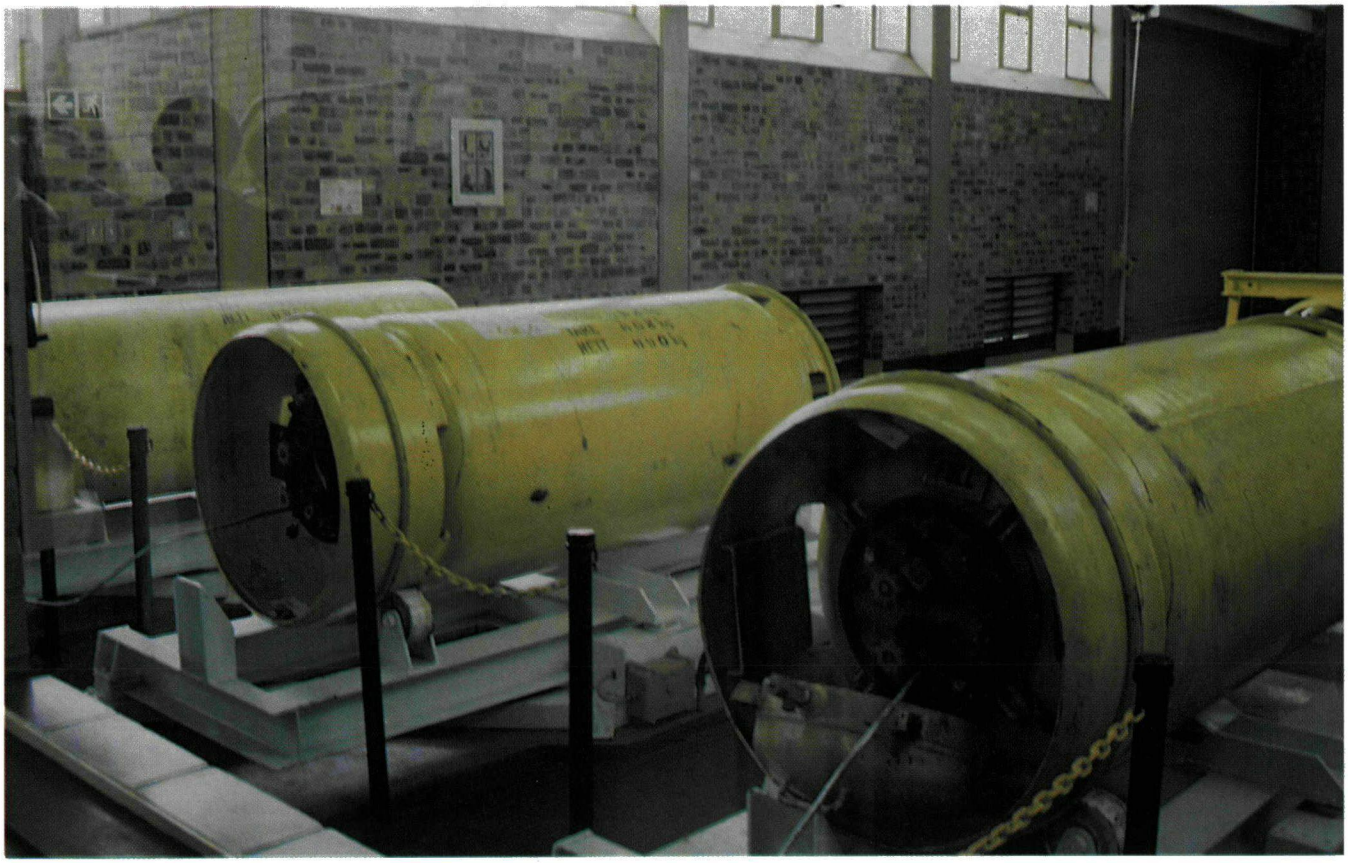
Copies of this publication entitled "The development of the new sediment yield map of southern Africa" (WRC Report 297/2/92) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price $20).





Sediment yield regions of southern Africa.

Mutagenisiteit in drinkwater – geen gesondheidsgevaar



Chloor word wêreldwyd gebruik as primêre ontsmettingsmiddel in drinkwaterbehandeling.

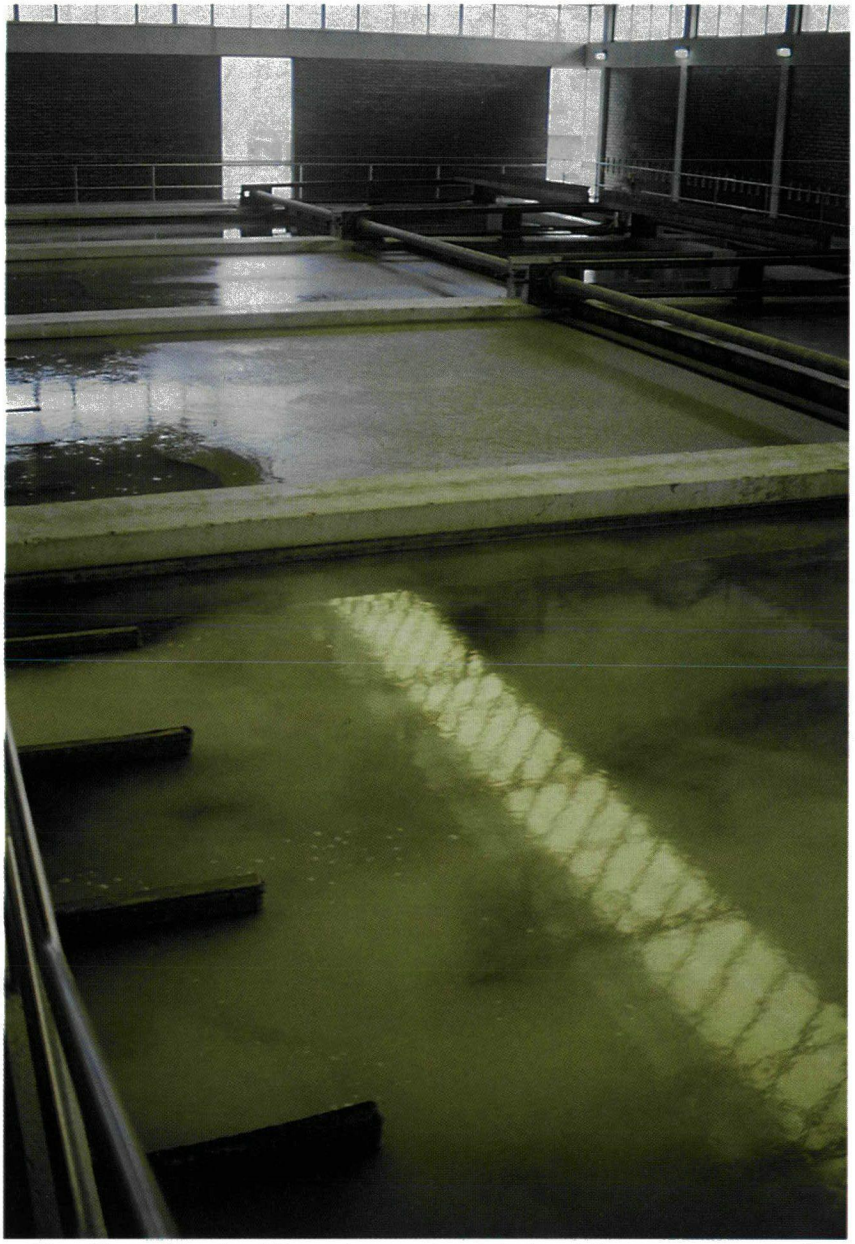
Water en lug is die hoof lewensbronne nodig vir voortbestaan. Dit is uiters noodsaaklik dat hierdie bronne geen gesondheidsgevaar inhou nie, aangesien die mens geen ander keuse het as om dit te gebruik nie, sê mevrou Benita Louw van Randwaterraad, in haar navorsingsverslag aan die Waternavorsingskomissie. Die doel van haar navorsingsprojek was om ondersoek in te stel na die voorkoms van mutagene stowwe in drinkwater geproduseer deur die Randwaterraad met behulp van die Ames *Salmonella* mikrosoom mutagenisiteit bepaling. Die navorsingsverslag getiteld **Die mutagenisiteit in drinkwater geproduseer met verskillende behandelingsmetodes uit oppervlakwaterbronne** (WNK Verslag nr 360/1/93) is gratis beskikbaar vanaf die Waternavorsingskommissie, Posbus 824, Pretoria 0001.

Oppervlaktewater is die belangrikste bron van drinkwater in Suid-Afrika. Plaaslik word hoofsaaklik gebruik gemaak van konvensionele behandelingsmetodes vir die produksie van drinkwater. Die volgende behandelingsprosesse word hoofsaaklik gebruik: voorchlorering (waar van toepassing), koagulering, flokkulering, sedimentasie, filtrasie en finale ontsmetting.

Chloor word wêreldwyd gebruik as primêre ontsmettingsmiddel. Die reaksie van chloor met organiese stowwe teenwoordig in rouwater, is baie bekend. Die chlorering van water kan moontlike chemiese mutagene produseer wat 'n moontlike gesondheidsgevaar skep. Onder sekere toestande reageer vry chloor met geselekteerde voorlopers in drinkwater om trihalometaanverbindings (THM) te vorm.

'n Mutageen is 'n chemiese of fisiese middel wat 'n permanente oordraagbare verandering in die genetiese materiaal van 'n sel kan veroorsaak. Dit is bekend dat mutasies een van die oorsake van kanker is en daarom is dit noodsaaklik dat hierdie saak meer aandag geniet. Korttermyn essaiering is nodig vir die bepaling van mutagenisiteit aangesien kroniese blootstelling aan sub-toksiese vlakke van chemiese verbindings oor 'n baie lang tydperk plaasvind voordat dit waarneembaar word. Die bekende Ames *Salmonella* mikrosoom mutagenisiteitstoets word wêreldwyd gebruik vir hierdie doel. Verskeie navorsers het getoon dat van die bekende karsinogene vir die mens, mutagenies is in dié toets. Die toets word ook gebruik om 'n groot verskeidenheid karsinogene, wat metaboliese aktivering benodig, op te spoor. Dit word gedoen deur die byvoeging van homogenaat van rotlewer (S9-mengsel) in die toets. Sekere epidemiologiese studies het 'n waarskynlike verband tussen die gebruik van drinkwater en die voorkoms van blaas, rektale en kolon kanker aangetoon maar geen definitiewe verband kon met sekerheid bevestig word nie.

Mutagene kan as sulks voorkom in rouwater wat besoedel is deur nywerhede en landbou (plaagdoders). Dit kan ook gevorm word deur chlorering van water wat humus- en fulviensure bevat. Behandeling van water met chlooramien, chloordioksied en osoon vorm ook byprodukte met potensiële gesondheidsgevaar maar in 'n mindere mate as chloor. Uit die literatuur is dit duidelik dat mutagenisiteit waargeneem kan word in drinkwater wat met chloor ontsmet is.



Plaaslik word hoofsaaklik van konvensionele behandelingsprosesse gebruik gemaak vir die produksie van drinkwater.

ROUWATER

Die tipe water wat gebruik word vir drinkwaterdoeleindes speel 'n groot rol in die vorming van mutagene. Hoogs besoedelde rouwater toon hoër mutagenisiteit as minder besoedelde water. As gevolg van die groot kommer oor by-

produkte wat vorm tydens die ontsmetting van water met chloor, word alternatiewe ontsmettingsmiddels soos chloordioksied, osoon, chlooramien en ultraviolet tans wêreldwyd bestudeer. Daar is gevind dat die hoeveelheid mutagenisiteit wat gevorm word deur hierdie verskillende ontsmettingsmiddels, gewoonlik die volgende relatiewe rangorde volg: chloor toon die hoogste mutagenisiteit, dan volg chlooramien, gevolg deur chloordioksied en daarna osoon met die laagste mutagenisiteit. Osoon kan egter in sommige gevalle net so 'n hoë vlak van mutagenisiteit tot gevolg hê as chloor. Verskeie metodes is bekend om organiese voorlopers wat tot die vorming van mutagene kan lei, te verwyder. Prosesse soos belugting, snelsandfiltrasie en koagulasie verwyder 'n gedeelte terwyl die doeltreffendste metode adsorpsie op geaktiveerde koolstof is. Die koolstof kan egter uitgeput raak en dan kan deurbraak van voorlopers tog voorkom.

Die Randwaterraad verskaf drinkwater aan meer as agt miljoen mense en dit is noodsaaklik dat die water geen gesondheidsnadelige verbindings bevat nie. As gevolg van die feit dat die Raad besoedelde oppervlakwater behandel en chloor as 'n vooroksidant vir die bekamping van algkonsentrasies en as primêre ontsmettingsmiddel gebruik word, vergroot die moontlikheid dat gesondheidsnadelige verbindings dalk mag voorkom.

Die navorser sê in die verslag dat die ondersoek dit moontlik sou maak om te bepaal watter tipe mutagene, soos aangedui deur die reaksie van die verskillende toetsrasse, teenwoordig is. Verder sou dit moontlik wees om te bepaal op watter stadium van die behandelingsproses die mutagene vorm en of daar 'n toename is in die mutagenisiteit in die verdeelstelsel nadat die water die suiweringsaanleg verlaat het. Spesifieke behandelingsprosesse soos geaktiveerde koolstof, chloordioksied en chlooramien is ondersoek. Totale trihalometaan (TTHM) bepalings is in parallel met elke toets gedoen om vas te stel of daar 'n moontlike verband bestaan tussen TTHM-konsentrasie en mutagenisiteit.

Vir die doeleindes van die ondersoek is die water in drie "groepe" verdeel:

'n Moderne waterwerke in Suid-Afrika waar rouwater behandel word om drinkwater te voorsien.

Groep I - rouwater en water vanuit verskillende behandelingstadia.

Groep II - water vanuit die verdeelstelsel tot waar dit die eindverbruiker bereik.

Groep III - water behandel met spesifieke prosesse om nadelige verbindings te verwyder of te verlaag.

WAARNEMINGS

Die volgende waarnemings is met die drie groepe gemaak:

Daar is geen mutagenisiteit waargeneem in die rou water of in die water vanuit die verskillende behandelingstadia nie. Mutagenisiteit is wel waargeneem in water direk na breekpuntchlorering.

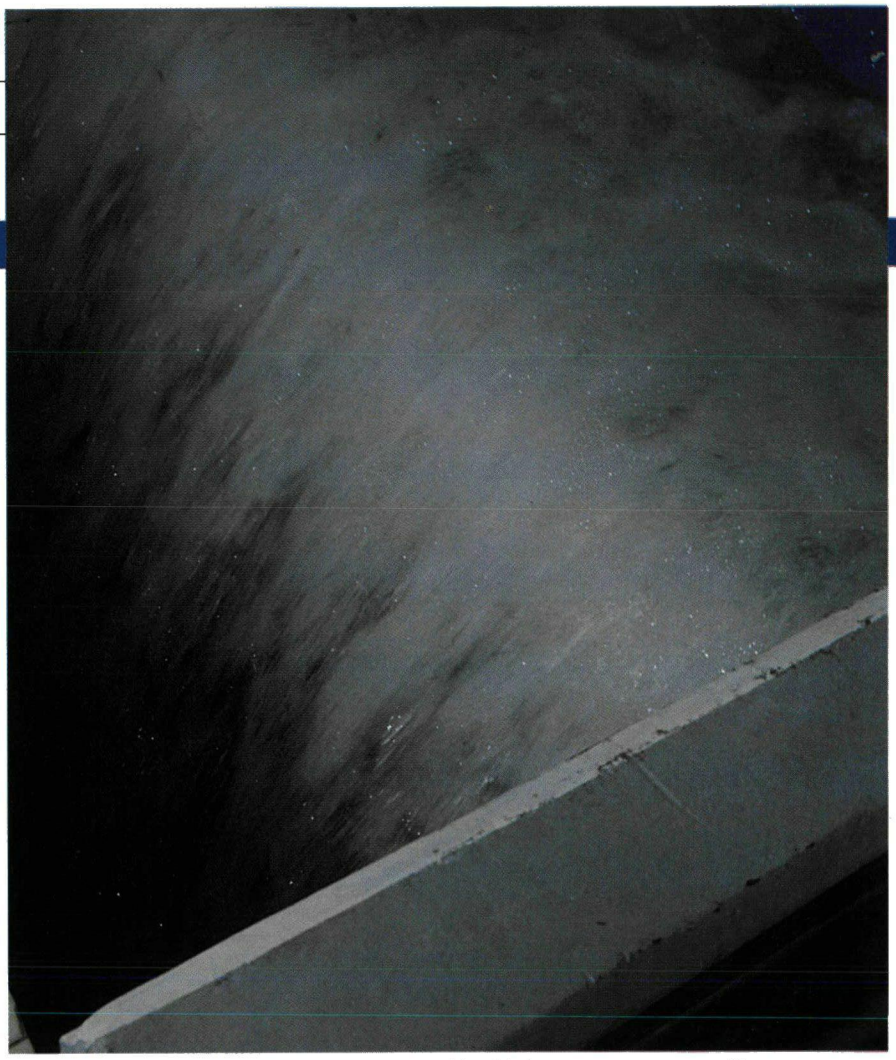
Mutagenisiteit is ook waargeneem in water vanuit die verdeelstelsel tot by die eindverbruiker. Hierdie mutagenisiteit het stelselmatig toegeneem. Geen verskil in die mutagenisiteit voor en na chlooraminering is waargeneem nie.

Die mutagenisiteit wat voorgekom het in

chloorbehandelde water is verwyder deur die geaktiveerde koolstof (GAC) behandeling. In die geval waar die koolstof uitgeput was, is laer mutagenisiteit wel waargeneem as in die geval waar GAC behandelde water met chloor behandel is. Daar is geen mutagenisiteit waargeneem in die geval waar GAC behandelde water met chloor behandel is. Verder is geen mutagenisiteit is waargeneem in water wat met chloordioksied of chlooramien behandel is nie.

Die S9-mengsel het in al die gevalle waar mutagenisiteit waargeneem is, die mutagenisiteit verswak of vernietig.

In al die resultate uit die drie groepe het die TTHM-konsentrasies en die waargenome mutagenisiteit 'n verband getoon. Met die toename in die mutagenisiteit het 'n toename in die TTHM-konsentrasies voorgekom. Die ontsmetting van water met chloordioksied of chlooramien het geen THM-verbindings gevorm nie, maar in die geval van chloorbehandeling het THM-verbindings wel gevorm.



Navorsing toon dat behandelde drinkwater geen wesenlike gesondheidsgevaar inhou nie.

GEVOLGTREKKINGS

- Mutagenisiteit kom voor in water wat gechloreer is. Dit is duidelik dat THM-verbindings gevorm word tydens die chlorering van water. Daar is 'n aanduiding van 'n moontlike verband tussen die TTHM-konsentrasie en mutagenisiteit.
- Mutagenisiteit het wel 'n geleidelike toename getoon in die waterverspreidingsnetwerk, waarskynlik as gevolg van die kontaktyd tussen die water en die chloor.
- Die GAC behandeling van water is doeltreffend vir die verwydering van organiese voorlopers. Chlooramien en chloordioksied kan gebruik word as alternatiewe ontsmettingsmiddels aangesien dit nie THM-verbindings vorm nie en geen mutagenisiteit waargeneem is nie.
- Die waargenome mutagenisiteit is van so lae orde dat dit geen gesondheidsrisiko inhou nie. Aangesien die S9-mengsel in al die gevalle die mutagenisiteit verswak of vernietig het, dui dit daarop dat die lewerensieme teenwoordig in die menslike liggaam die mutagenisiteit van moontlike mutagene verswak of vernietig. Die waargenome TTHM-konsentrasies was ook laer as die aanbevole limiet van 100 µg/ℓ. Daar kan dus aanvaar word dat die drinkwater soos verskaf deur die Randwaterraad, op hierdie stadium geen gesondheidsgevaar vir die mens inhou nie.

AANBEVELINGS

Volgens die navorsingsverslag moet die Amestoets slegs as 'n uitsiftingstoets gebruik word. Nadat mutagenisiteit waargeneem is met die Amestoets, behoort die mutagene geïsoleer en geïdentifiseer te word. Hierdie stowwe moet dan *in vivo* getoets en bevestig word as karsinogene.

Die verband tussen die THM-verbindings en die waargenome mutagenisiteit dui daarop dat die verwydering of verlaging van die verbindings of die voorlopers, die probleem van mutagenisiteit kan oplos.

Die gebruik van osoon om mutagenisiteit te voorkom moet ondersoek word.

Totale organiese halogene (TOX) bestaan uit vlugtige stowwe (THM-verbindings en ander) en nie-vlugtige stowwe. Hierdie nie-vlugtige stowwe beslaan 'n groot gedeelte van die TOX-verbindings. Daar behoort dus ondersoek ingestel te word na die verband tussen mutagenisiteit en TOX-verbindings.

New decision support system will help planners select appropriate sanitation for developing communities

by Dr J Howard*, Ms Benita Olën** and Mr Nevil Quinn**

The Water Research Commission is funding a three year project at Umgeni Water in Natal which aims to develop a prototype sanitation decision support system to address the need for sound decision making in this area.

Surcharging sewers resulting from poor design, misuse and lack of maintenance may introduce large volumes of faecally contaminated effluent into the water environment with attendant health risks.

It has been estimated that only one in every two people in South Africa, in both urban and rural areas, has access to adequate sanitation facilities. There is a direct relationship between inadequate water supply and sanitation and disease and mortality. Access to an adequate supply of potable water and sanitation facilities are basic needs and there is clearly an urgent need to improve on the current situation within developing communities.

PLAN

Initiatives such as the Umgeni Water Rural Areas and Sanitation Plan, which strives to provide adequate potable water and appropriate sanitation to all within the Umgeni Water's area by the year 2005, are to be welcomed. However, while the provision of potable water is largely a technical issue, the provision of sanitation is a far more difficult task with many constraints. Developing communities are often not aware of the link between sanitation and health. Although sanitation facilities are sought after for reasons of convenience and privacy, they are often considered an unaffordable luxury.

Inappropriate sanitation may ultimately cause a marked deterioration in the bacteriological and nutrient status of surface and ground water which may impair the suitability of the affected water for its many uses. It is therefore clear that sanitation and water supply are mutually interdependent and need to be approached within a framework of integrated water planning.

In South Africa there is no formal framework with which informed decisions about the introduction of sanitation technology to developing communities can be made. Decisions are often made on an *ad hoc* basis and are based largely on affordability. Environmental and sociological characteristics of an area are generally not considered or are misunderstood. Anecdotal evidence of groundwater pollution arising from pit latrines or of the tendency for particular communities to abuse waterborne sewage systems, is often used to guide decisions.

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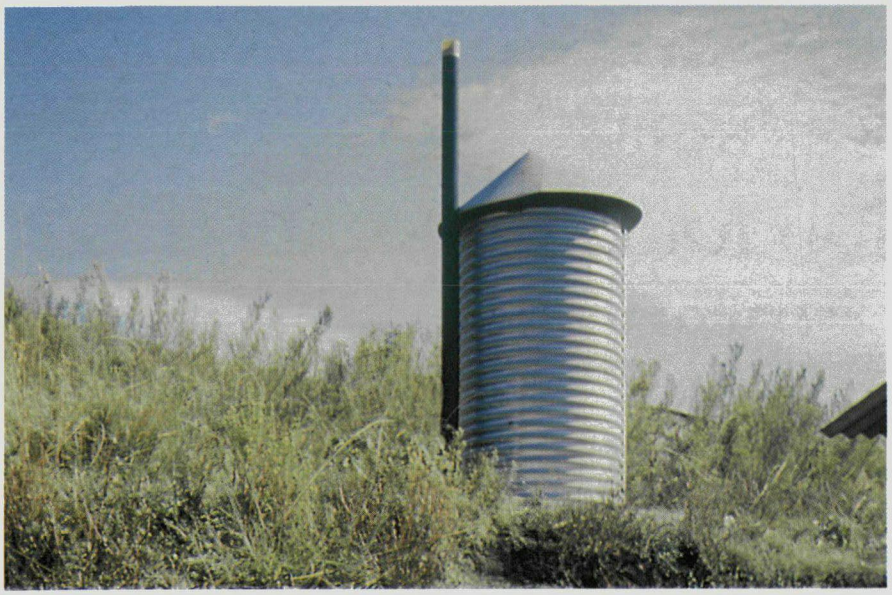
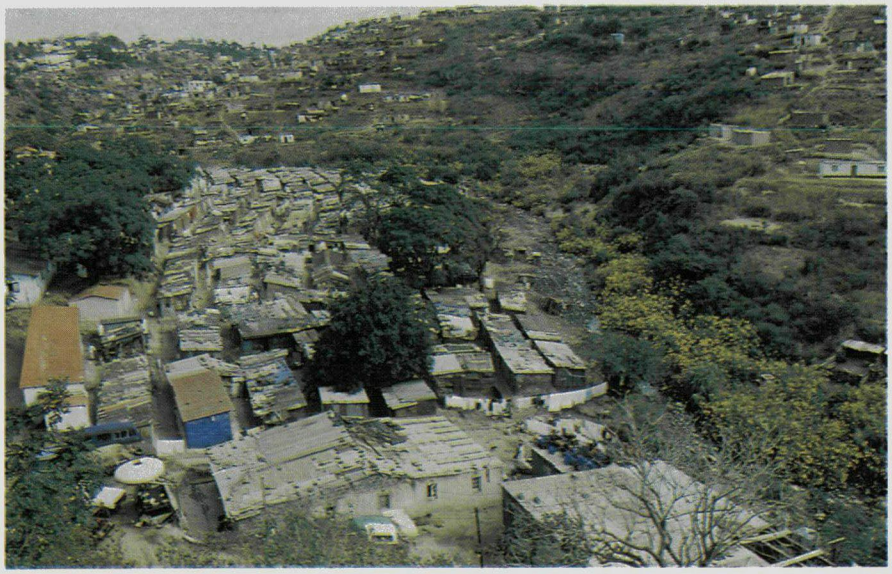
** Institute of Natural Resources, PO Box 375, Pietermaritzburg 3200. Telephone 0331-68 317.



Ventilated improved pit latrines (VIP) must be carefully sited to prevent surface and ground water contamination from occurring.



Access to an adequate supply of potable water and adequate sanitation are basic needs. The selection of appropriate sanitation systems must consider environmental, sociological and economic factors.

It is therefore important that a process of considering the multiplicity of factors which influence the selection of appropriate sanitation is needed to substantiate and support informed decision making. It is in response to this that the sanitation decision support system is being developed, to consolidate the best available information on economic, environmental, sociological and practical factors.

OBJECTIVES

The project has the following objectives:

- To synthesise relevant available information in the local and international literature, from other sources such as unpublished documentation on appropriate sanitation for developing communities in general and on selection of technical options in particular. Further, to identify gaps in the existing information and make recommendations for research needed.
- To identify experts in the fields of provision of appropriate sanitation to developing communities and in the development of decision support systems, as well as other interested parties and community representatives and invite their participation and input in building the sanitation decision support system.
- To evaluate the potential physical environment impact of different technologies with specific reference to ground and surface water quality.
- To design a decision support system which at its most sophisticated level is PC-based and can be linked to a GIS with a structure and content compatible with the requirements of the end user(s), namely, a practical and workable tool.
- To ensure that the technology developed is transferred effectively to the end user(s) and that the sanitation decision support system can be effectively implemented.
- To make recommendations for the support structures (such as integrated Water Planning and an Education Campaign) for the sanitation decision support system.
- To establish communication with other groups involved in research into or implementation of appropriate sanitation technology in developing communities, to prevent duplication of effort and for mutual benefit to such other groups as well as this project.

ASSISTANCE NEEDED

The researchers would welcome the involvement of any interested parties that may be able to assist with the development of the system. Of particular interest would be field data that has been gathered concerning the impact of different sanitation types on ground and surface water quality.

The researchers would also like to make contact with any service organisations that would be interested in the application of the sanitation decision support system to assist with sanitation selection for developing communities within their areas of jurisdiction.

Useful titration methods pr
in new WRC manu

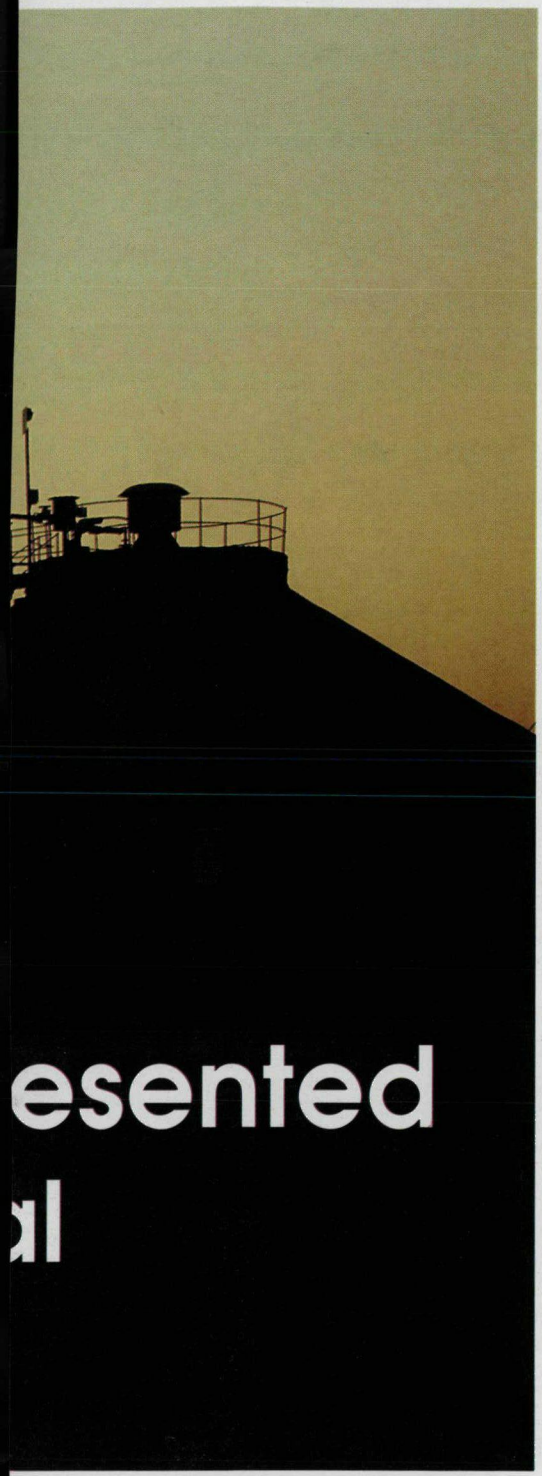
A research project, financially supported by the Water Research Commission, has led to the development of simple titration procedures for determining H_2CO_3* alkalinity and short-chain fatty acids in anaerobic fermentation systems.

[H_2CO_3* = (CO_2dissolved) + (H_2CO_3)]

The titration procedures are summarised and explained in a new manual, supported with two computer programs, which the Water Research Commission has recently published.

According to the researchers, RE Moosbrugger, MC Wentzel, GA Ekama and GvR Marais, from the Water Research Group at the University of Cape Town, successful operation of anaerobic systems depends on, amongst others, the maintenance of a near neutral pH in the reactor liquid.

The pH established in an anaerobic sys-



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tem is the result of the interaction between the weak acid/bases present. In the desired operating pH range (between 6,6 and 7,4), the main weak acid/base buffering against pH change is the carbonate [characterised by H_2CO_3*alkalinity and pH or total species concentration (C_T) and pH] and the main weak acid/bases causing pH decline are the short-chain fatty acids [characterised by total species concentration (A_T) and pH]. For pH control in anaerobic systems, monitoring these weak acid/bases is essential.

However, the researchers say, the numerous difficulties with existing methods for measurement of these weak acid/bases preclude their widespread use. "For direct measurement of total species concentrations (C_T and A_T), there is a lack of the necessary expensive sophisticated equipment at most full-scale installations in South Africa, and for the existing indirect titration techniques, the methods are cumbersome and provide only approximations of the parameters of interest.

MANUAL

To overcome these problems, two simple titration procedures are presented in this new manual: a 4 pH point titration for determining the carbonate weak acid/base and a 5 pH point titration for determining both the carbonate and short-chain fatty acid weak acid/bases in aqueous solutions. Besides the carbonate and short-chain fatty acid weak acid/bases, the most common additional weak acid/bases in anaerobic digestion are phosphate, ammonium and sulphide. These can be accounted for in the titration procedures if their total species concentrations are known. Where these are not available, guidance is given on their influence on the accuracy of the results.

The titration methods presented in the manual require only an acid titration over the middle range of pH (initial pH to pH 6,7; 5,9 and 5,2 for 4 pH point titration and to additional pH 4,3 for 5 pH point titration). If the initial pH is below 6,7 then strong base addition is required to reach pH 6,7 before the strong acid titration can be commenced. However, the requirement is only to increase the pH to 6,7 i.e. there is no need to standardise the strong base.

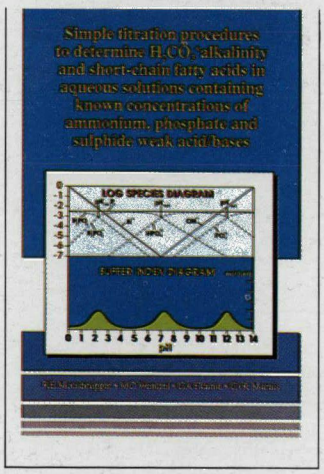
The researchers say these features of the titration methods provide decided advantages over existing methods in testing time required and simplicity of testing procedure and overcome criticisms levelled at previous titration methods of difficulties in adequate pH probe calibration due to large pH ranges and precipitation.

PC PROGRAMS

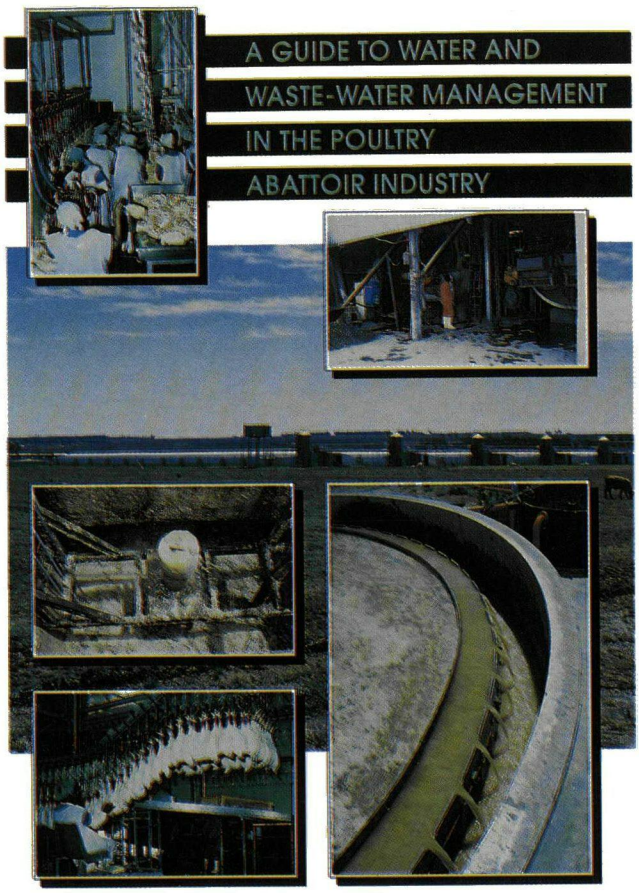
Algorithms for calculating the carbonate C_T and H_2CO_3*alkalinity from the 4 pH point titration data or the carbonate H_2CO_3*alkalinity and short-chain fatty acid A_T from the 5 pH point titration data, have been encoded into two computer programs called TITRA4 and TITRA5 respectively, which are included with the manual.

Besides quantifying the carbonate or carbonate plus short-chain fatty acids, the computer programs allow a check on the pH probe by providing an estimate of a systematic pH error where this may be present, due to poor calibration, residual liquid junction effect or any other influences on the glass electrode. The systematic pH error is taken into account automatically by the computer programs in the calculations. This increases the accuracy of data derived from the titration procedures.

The researchers say the titration procedures presented with this manual should find wide use for routine monitoring of anaerobic digestion systems and for a range of other applications.



Copies of this manual entitled "Simple titration procedures to determine H_2CO_3* alkalinity and short-chain fatty acids in aqueous solutions containing known concentrations of ammonium, phosphate and sulphide weak acid/bases" (WRC report TT 57/92) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: $40,00.)



WRC water Guide for poultry abattoirs

A guide to water and waste-water management in the poultry abattoir industry has been released by the Water Research Commission.

The Guide has been drawn up from work carried out during the course of a project entitled "Research on and an investigation into the use of physical/chemical techniques for water and waste-water management in the meat processing industry", conducted initially on behalf of the Water Research Commission by Binnie & Partners and subsequently continued by consulting engineers, Steffen, Robertson and Kirsten.

In the foreword to the Guide, Mr J Cawson of the South African Poultry Association says that poultry abattoirs are generally large consumers of water - a resource which in years to come is going to be more difficult to provide and will certainly be a lot more expensive.

"One of the surprising facts to come from this research," he says, "was the great variation in volumes of water used by different poultry abattoirs, even though all have to comply with the same meat hygiene regulations. This more than any other factor emphasises the scope for savings in the industry."

Mr Cawson says another important aspect of the report deals with several simple techniques that can be used to reduce the pollutant load and hence the cost of treatment.

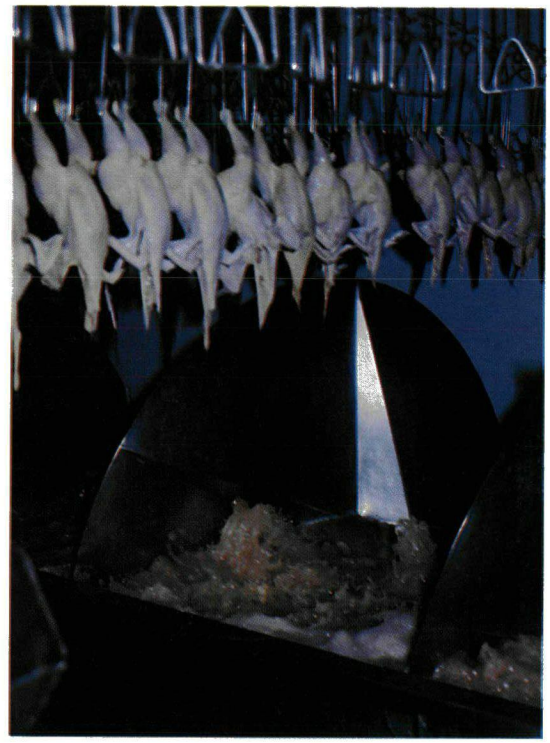
"If these methods are used together with effective treatment of water, then it should be possible to recover a proportion of the water for reuse in certain areas which could go a long way to offsetting the cost of treatment.

"As an industry we must thank the Water Research Commission for taking the lead in waste-water research and producing this Guide which will, we hope, lead all poultry abattoirs to employ or further investigate these proposed conservation and treatment methods."

Copies of the Guide are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price $20)

The national poultry rearing and abattoir industry in South Africa has in recent years showed an accelerating rate of growth. Over the period 1981 to 1991, broiler production by the industry has more than doubled, from around 180 million birds per annum in 1980/81 to more than 360 million birds per annum in 1990/1991. In 1989 poultry was found to account for approximately 40 per cent by mass of all the meat (red and white) produced in South Africa. Because of the higher cost of red meat versus white meat, the increasing proportion of white meat is expected to continue and probably accelerate.

Poultry abattoirs are graded according to their maximum permissible throughput into five grades, namely, AP (slaughtering more than 10 000 birds per day) to EP (slaughtering a maximum of 50 birds per day). AP-grade poultry abattoirs constitute only a small fraction (13 per cent) by number of the total number (149) of abattoirs in South Africa, but carry out the bulk of the production, namely, more than 93 per cent of the total number of broilers processed annually.



SWI

Specific water intake (SWI) values (the water intake for a particular period divided by the number of birds used in production during the same period) observed at poultry abattoirs show that the AP-grade abattoirs tend to be more water efficient, with a mean SWI value of 17 ℓ/bird, compared with BP and EP-grade abattoirs with mean SWI values ranging from 20 to 25 ℓ/bird. Because of the high proportion of total production carried out by the AP-grade abattoirs, these abattoirs, however, are responsible for around 90 per cent of the total water intake by the industry. With regard to the breakdown of water use, processing (63 per cent) and washdown of plant equipment (22 per cent) account for 85 per cent of the water used in AP-grade abattoirs. Target SWI values proposed in the Guide are ultimately a maximum of 15 ℓ/bird for AP-grade abattoirs and 18 ℓ/bird for other grade abattoirs.

Opportunities for reducing water use and recommendations for improving water management are given in terms of water metering, processing areas, heating and cooling and washdown of plant and equipment. Opportunities for reclaiming and recycling water are identified and the potential for water saving in the industry is indicated in the Guide to be around 1 600 Mℓ per annum, which is equivalent to 29 per cent of current consumption by the industry.

EFFLUENTS

In large, modern AP-grade abattoirs, the specific effluent volume (SEV) is typically around 15 ℓ/bird and the specific pollutant load (SPL) in terms of chemical oxygen demand (COD) is typically around 27 g COD/bird. The principal contributors to specific effluent volume and specific pollutant load are the following operations:

- Evisceration (the removal of organs (viscera) from a slaughtered bird): 33 per cent of SEV and 48 per cent of COD SPL.
- Washdown: 22 per cent of SEV and 35 per cent of COD SPL.
- Scalding: 17 per cent of SEV and 11 per cent of COD SPL.

Nationally, pollutant loads estimated for the industry are an effluent volume of 4 900 Mℓ/a and mass pollutant discharges of 10 255 t/a of COD, 2 450 t/a of suspended solids (SS) and 4 970 t/a of total dissolved solids (TDS).

Target values for specific effluent volume and pollutant load are identified in the Guide for AP-grade and other grade abattoirs. Opportunities for improved effluent management are identified in terms of specific actions the industry can undertake in order to aim towards the target specific effluent volume and pollutant load values given.

Poultry abattoir effluents are usually discharged to municipal sewerage systems and in order to meet applicable by-law quality requirements, on-site effluent pretreatment is generally required. Relevant aspects discussed in the Guide include improved housekeeping, gross solids handling, grease removal, screening, primary settling, effluent segregation, effluent balancing, chemical dosing and air flotation, as well as the potential for enhanced effluent treatment and water reclamation using membrane processes.

WRC publishes a South African DAF design guide for the water industry

The need for this publication - a South African Design Guide for Dissolved Air Flotation (DAF) by Johannes Haarhoff and Lucas van Vuuren - was born after the realisation that a great deal of South African design and operational experience has been accumulated over the years and that it would be of value to local and overseas designers alike to record this experience together with a critical analysis of the key DAF design parameters.

The Guide deals with the application of dissolved air flotation to the fields of drinking water treatment and activated sludge thickening. Two applications are typically encountered, namely:

- The **clarification** of eutrophic surface water for drinking water purposes and sewage effluent prior to disposal or secondary reuse.
- The primary **thickening** of sewage sludge and waste activated sludge, prior to disposal or secondary dewatering.

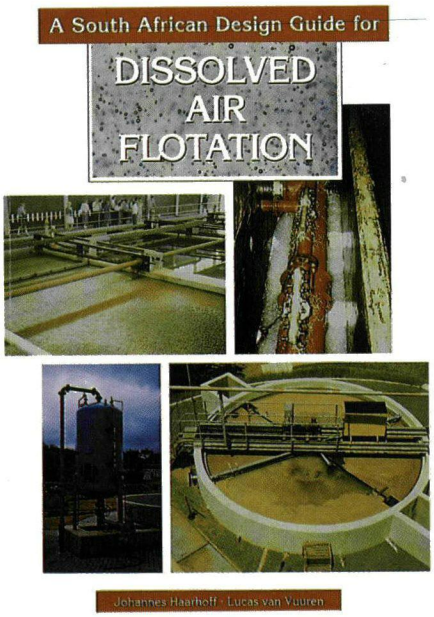
CONTENTS

Chapter 2 of the Guide starts out with a comprehensive literature review of dissolved air flotation under the following main headings:

- The reaction zone
- The requirements for chemical pretreatment
- The bubble production system
- The flotation zone
- The removal of the float layer

Much of the underlying theory is common to both clarification and thickening applications, but the areas where the two applications diverge, are highlighted.

Chapter 3 describes the development of the use of dissolved air flotation in Southern Africa from the early days when



it was first used in the historical waste-water reclamation plant in Windhoek, Namibia, during the sixties. The fundamental and applied academic research, coupled with a multitude of pilot projects at numerous locations and applications, led to the construction of many full-scale plants that are still successfully operating today.

Chapter 4 moves onto a detailed survey of 26 dissolved air flotation plants in Southern Africa, covering both clarification and thickening applications. Good data have been compiled on the design parameters as well as on what the current operating parameters are. An attempt was also made to assess the efficiency of the process. These data are less complete, but nevertheless yielded useful information. In general it was found that there is relatively little variation in the design parameters amongst the clarification plants, but that much more variation exists amongst the thickening plants. Not surprisingly, there is a similar difference in perception amongst the operational personnel. A positive attitude towards dissolved air flotation was the rule where it was used for clarification, while mixed responses were received where it was used for thickening. A major area of complaints for both thickening and clarification is that of unreliability of, and maintenance problems with, mechanical equipment, particularly the float scrapers.

From the data of the plant survey, as well as from the literature study, a set of empirical design parameters could be formulated in Chapter 5. Not all parameters could be satisfactorily defined. In such cases a guideline value was omitted or tentatively set. In the case of defining reaction zone turbulence, some difficulty exists in finding an appropriate parameter and in defining the boundaries of the reaction zone. The authors adopted the simplistic, tentative parameter of mean flow velocity through the reaction zone.

The practical use of the empirical guidelines is demonstrated in Chapter 6 for both a clarification and thickening application. The typical calculation for a fixed injection nozzle is also illustrated, as well as a way of analytically handling an adjustable recycle flow rate.

An assessment of the current research needs is finally made in Chapter 7. The authors concur with recent international views that, while a great deal of research went into initially demonstrating that dissolved air flotation could be a viable alternative to other better known phase separation processes, little research has subsequently been directed at optimising the numerous variables for different applications. A number of specific research needs are pointed out which were encountered during the survey of Southern African dissolved air flotation plants.

Copies of the design guide are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US $45).

SANCIAHS
A profile of its membership

SANCIAHS secretary, Mr Hugo Maaren, comments on a recent membership survey: Some time ago this year we sent out a fairly comprehensive questionnaire to our registred membership of 330 members. To date 106 returns have been received. The following gives some detail on the results:

Age	(%)
Under 25	1,9
25-34	13,3
35-44	42,9
45-54	27,6
55-64	7,6
Over 65	6,7

Highest Academic qualifications	(%)
Diploma	1,9
1st Degree	12,5
Honours	11,5
Masters	45,2
Doctorate	28,9

Professional registration	(%)
Engineer	36,8
Natural Scientist	29,2
Other/None	34,0

Discipline of primary academic qualification	(%)
Civil Eng	38,5
Other Eng	3,9
Agric/Forest	9,6
Hydrology	9,6
Geography	12,5
Geology	8,7
Env. Sciences	3,9
Life Science	4,8
Chemist/Bioch	2,9
Other	5,8

Employment	(%)
Consultant	33,7
Researcher	25,0
Manager	16,4
Research	10,6
Teacher/lecturer	11,5
Technician	2,9

Employer	(%)
Private Consultant	30,4
University/Technician	25,5
State department	15,7
Other	11,8
CSIR	10,8
Retired	2,9

Main job involvement	(%)
Surface hydrology	61,2
Water demand/supply	39,8
Water quality	32,0
Groundwater hydrology	26,2
Agriculture/Forestry	17,48
Limnology/Ecology	12,6
Irrigation	12,6
Waste water	11,7
Meteorology	4,9

NB The percentages don't add up to 100% because people could indicate up to three different categories. (Same applies below where all options could be selected)

What did members expect from SANCIAHS?	(%)
National Symposia	69,2
Newsletter	64,4
International liaison	59,6
Specialist meetings	55,8
Regional meetings	43,3
Professional home	32,7

From this it has become clear that only 34% of the people that are not registred professional engineers or natural scientists are still looking for a professional home.

The newsletter is seen as important and it is interesting to see what people said about our SANCIAHS column in this SA Water Bulletin.

SA Waterbulletin Column

50% found the column okay (Fine).
31% wants more news items but 20% don't know about it? About 15% indicated they would be able to contribute to the contents of the news column and I will explore (exploit) this opportunity. It seems that the expectation of members are reasonably attended to but a great hiatus is the lack of regional and specialist meetings!

Comments on strategic plan

We have received a large number of comments from members and I want to thank the people for taking time to do so! The comments cover a wide variety of topics but some major trends can be seen:

- Many feel the meaning of the word hydrology and the role of hydrologist in society is not clear and SANCIAHS has to embark on a concerted and prolonged campaign to redress this.
- Many agree that education of hydrologists should be a major concern of SANCIAHS.
- More effort should be put in to extending the interest field into Southern Africa or the SADC region (from Tanzania, Zambia and Angola southward).

Workshop gives SAWIC future direction

Many readers of the SA Waterbulletin responded to a SAWIC questionnaire which was sent to a comprehensive group of users of water information towards the end of last year. The response was most gratifying and we would like to express our thanks to everyone who took the trouble to complete the questionnaire. The questionaire also brought to the fore some very interesting suggestions.

WORKSHOP

In June this year a workshop was held to review the activities of the South African Water Information Centre and to obtain input from a representative group of users for the planning of future activities and services of the centre. The results of the abovementioned questionnaire were circulated to the participants before the workshop.

The workshop took the form of a series of presentations covering the history of the South African Water Information Centre, the technology transfer mission of the Water Research Commission and different aspects of water information. This was followed by a discussion of the various suggestions arising from the questionnaire and the presentations.

The main conclusion reached was that the South African Water Information Centre is essential to the South African water community. It was also apparent that users of SAWIC services are becoming increasingly computer literate and require more facilities to access information directly rather than having to work through a third party. The fact that WATERLIT is now accessible both on-line through CSIR Information Services' Info Access System and available on CD-ROM as well, addresses this need. A wide range of international databases are now also accessible from a personal computer through the Worldnet Gateway.

SA WATER INFO

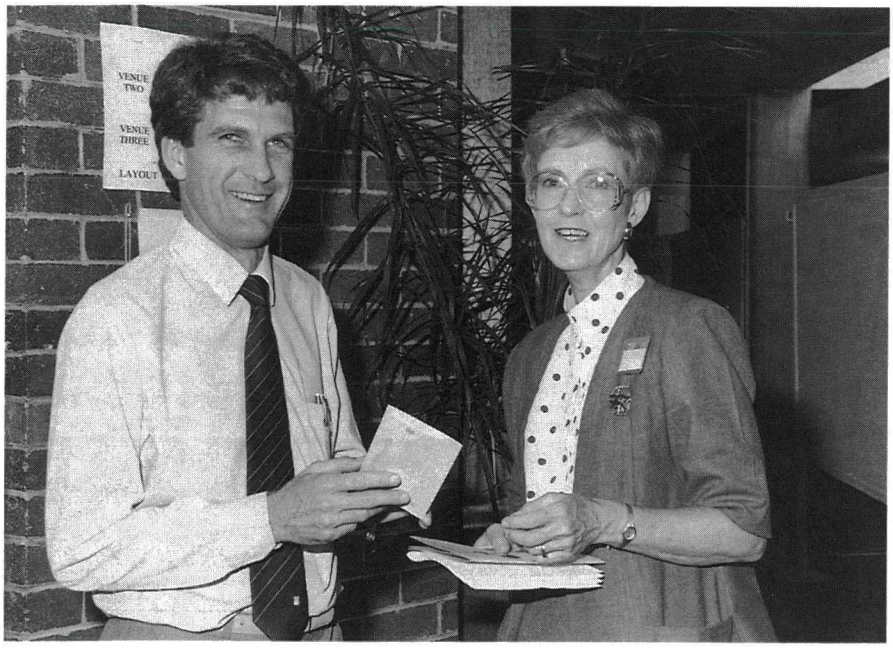
WATERLIT covers a very wide range of local and international publications. Special emphasis is placed on Southern African information and topics such as appropriate technology and developing communities will be monitored particularly carefully.

ABSTRACTS

Several users have requested that abstracts be added to the WATERLIT references. However, the writing of abstracts for the database would be a very expensive undertaking. Therefore it was agreed at the workshop that, during the next year, other possible methods would be tested.

DOCUMENT SUPPLY

The question of document supply was also raised. WATERLIT now contains more than 200 000 references and it is impossible to hold copies of all the source documents. Copyright conditions also prevent the free copying and provision of these items. Libraries and document supply centres can provide copies of all the original articles on request. Alternatively reprints may be requested from the authors.



Dr Mark Dent, Manager of the Computing Centre for Water Research (CCWR) and Mrs Angela Rethman, Manager of the South African Water Information Centre (SAWIC), having a word about water information.

UNPUBLISHED REPORTS

There is an immense amount of valuable information in the form of unpublished reports and brochures which is not included on databases. Attention will be given to devising methods of making this more accessible.

There appears to be a need for processed information apart from the provision of references and documents. SAWIC does provide services such as trend analyses and summaries of information on specific topics on demand.

CCWR

At the workshop it was agreed that closer links should be established with the Computing Centre for Water Research (CCWR) at the University of Natal in Pietermaritzburg, to ensure that all possible sources of water information are made available to the users.

Presently SAWIC is developing a network of sources of water information and seeking ways of making this generally accessible to Waterlit users. Software packages which help with the management of personal information collections are also being assessed.

A suggestion was raised that SAWIC should develop a database of product information. This would be a costly undertaking and it was decided that this did not fall within the contract with the Water Research Commission, but should rather be a self-funding project. SAWIC staff would be available to advise anyone undertaking this project.

FEEDBACK

Ultimately, the degree to which SAWIC can fulfil the requirements of users depends on the feedback received from the users. Mrs Angela Rethman, project manager of SAWIC, says that they will be very grateful to receive ideas and suggestions.

Visitors are welcome to visit the SAWIC offices at CSIR Information Services in Pretoria, telephone the Centre at (012) 841 3083/2048 or contact them via Internet

SA DATABASE OF WATER-RELATED RESEARCH PROJECTS

Many researchers have in the past weeks received copies of the records of their research projects which are entered on the Database of Water-related Research Projects.

The aim of the database, which is now being managed by the South African Water Information Centre (SAWIC) on behalf of the Water Research Commission (WRC), is to make information on water-related research, taking place in South Africa, available to all researchers, funding organisations and interested parties in South Africa. This information should help to aviod the duplication of research and also make researchers aware of people working in related fields.

Please check the details of your research projects on the forms, amend if necessary and return the forms to SAWIC as soon as possible. Researchers whose projects are not yet registered on the database may contact the South African Water Information Centre, PO Box 395,PRETORIA 0001.(Telephone (012) 841 2048. Internet:sawic@csir.co,za) for copies of the registration form.

The database can be accessed on-line through the Computing Centre for Water Research (CCWR). The route for users registered with the CCWR is ccwr-menu,9,4. Searches may be carried out in this format by entering a keyword preceded by a slash, or the database may be exported to database software.

TURBIDITY MEASUREMENT FOR VARIOUS WATER APPLICATIONS

The turbidity sensor.

Endress & Hauser has added another dimension to their successful range of analytical transmitters. The line covers six different parameters, namely, pH, REDOX, conductivity, dissolved oxygen, residual and total chlorine and now Turbidity.

Turbidity measurement is applicable to almost every water treatment application including waste water, sewage, drinking water and monitoring filter effluent, precipitation processes and public waters. Process applications include filter breakage monitoring, food production, emulsions, beer and drink production. It is used in pharmaceutical and chemical process engineering, metallurgical applications and power plants. This system adjusts to the process to be monitored, is simple to set up and operate and provides long-term stability and security of measurement by self-monitoring and system diagnosis.

The measurement and control system comprises a CUS1 turbidity sensor with an integrated temperature sensor, an immersion or insertion assembly and a Mycom Turbi unit.

Using the latest technology in signal processing the CUS1, 90° scattered light turbidity sensor can cover a very wide range of 0 - 4 000 NTU. Any part of the scale can be zoomed in on, e.g. 5 - 15 NTU.

Standard features include a panel of field mounting options for harsh plant conditions, pass code protection, adjustable alarms and air bubble suppression. A second current output is available for monitoring the process temperature, automatic sensor cleaning and a RS 232 or RS 485 serial interface.

Enquiries: Endress & Hauser (Geoff Wickens), Box 783996, Sandton 2146. Tel (011) 444-1386, (021) 591-1171 or (031) 861-221/2.

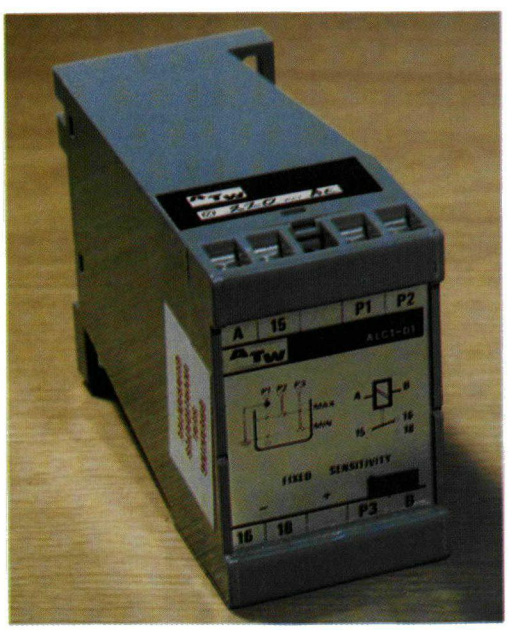
LEVEL CONTROLLER MANAGES BOREHOLE PUMPS

The ATW liquid-level controller is designed for use with simple electrodes operating with up to 45 kΩ liquid resistance, which is within the normal ground water figure. Any conducting material can be used for electrodes. Special electrode materials are not required because of the low current, less than 1 mA, and high sensitivity of the controller.

Available from Sprecher & Schuh, the controller can be supplied for voltages ranging from 12 - 380 VAC, or 12 - 36 VDC. One set of 5 A changeover contacts are fitted to switch the pump starter, and if required, a timer can be added for erratic flow or turbulent conditions.

The control relay is arranged in a high grade moulded case suitable for either 2-screw fixing into a panel or starter, or by snap-action on to a standard 35 mm DIN rail. A plug-in version is also available.

Enquiries: Sprecher & Schuh (Geoff Gregson), PO Box 61506, Marshalltown 2107. Tel (011) 493-5022. Fax (011) 493-2425.

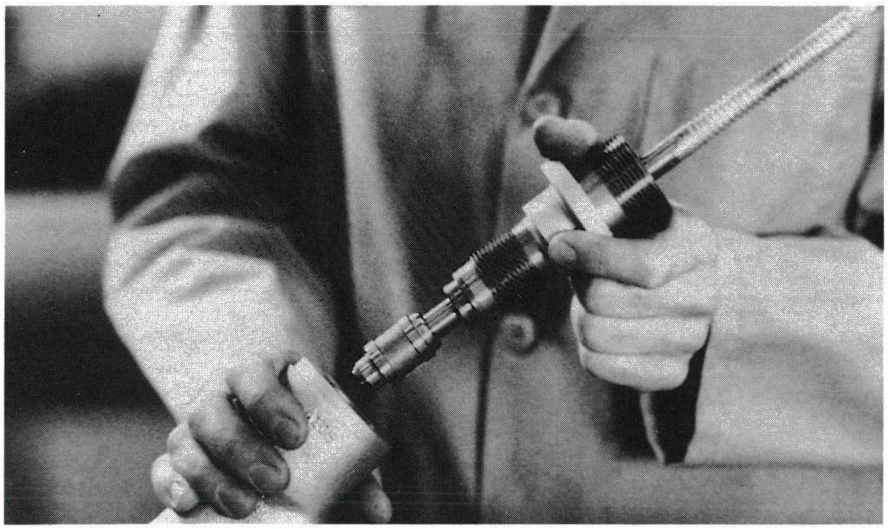


The ATW liquid level controller from Sprecher & Schuh.

UNIVALVE FOR IN-LINE MAINTENANCE

The Edward Univalve (formerly Rockwell) is designed for high pressure systems demanding a dependable, high quality valve with low pressure drop, and capable of being serviced in-line with the minimum of fuss.

The two-piece yoke-bonnet assembly facilitates fast in-line disassembly and allows close inspection of the integral stellite seat, which is sufficiently substantial to withstand many refinishings using simple-to-use tools.



Removing the valve bonnet-stem-disc assembly of an Edward Univalve for maintenance. The valve body remains on-line.

The solid stellite disc, which is body-guided to minimise side loads on the stem, is easily refinished using conventional tools should this be required. The special stem packing system utilises flexible graphite packing with carbon fibre anti-extrusion rings, which are all easily replaceable.

The Edward Univalve is available from Worcester Audco on a fast delivery basis, as Stop or Stop Check valves Class 1690 to 4500, in sizes $^{1}/_{2}$" to 4", supplied complete with full maintenance instructions. A training video is also available on request.

Enquiries: Worcester Audco SA (Pty) Ltd (Brian Holford), PO Box 8185, Elandsfontein 1406. Tel (011) 826-1421 Fax: (011) 826-1430.

FISHLIT COMPUTERISED DATA BASE ON COMPACT DISK

Fishlit, the comprehensive computerised database on fish and fisheries, developed by the JLB Smith Institute of Ichthyology Library at Rhodes University, is now available on compact disc (CD). The database consists of more than 36 000 references at present, and grows by about 500 references a month.

The database covers all aspects of the study of fish - marine, freshwater and estuarine. It includes all branches of Ichthyology, Fisheries Science and Aquaculture, such as: taxonomy, behaviour, biology, ecology, physiology, biochemistry, conservation, fishery management and aquariology.

Fishlit contains references from periodicals, articles, reports, pamphlets and other literature on fish from all over the world. It holds over 1 000 journal titles on fish-related subjects and has the addresses of more than 25 000 authors. As the data base is extensively keyword-indexed, references can be retrieved through any combination of search terms. In addition illustrations and new species descriptions are searchable and information can be retrieved by family, species or common name.

The Fishlit service, offering retrospective searches and a current awareness service, has been widely used in South Africa since 1985. The CD will open access to this information resource for the rest of the world.

Mrs Margaret Crampton, head of library and information services at the Institute, designed and developed the data base over a period of ten years. In 1985 the old-fashioned card catalogue was computerised. The programming for this system was devised by Professor Malcolm Sainsbury of the Department of Business Information Systems at Rhodes University and includes many innovative features.

An American firm, National Information Services Corporation (NISC), contacted Mrs Crampton in July last year and enquired about the possibility of publishing the Institute's data base on CD. This CD is now published and combines the data base of JLB Smith Institute with those of the US Fish and Wildlife Service, the US National Oceanic & Atmospheric Administration and the US National Fisheries Research Centre. It provides a total of 135 000 references. By combining these four major data bases, the gaps which may exist in one have been greatly reduced and in most cases eliminated by other files.

Mrs Crampton, a qualified librarian who also holds a Masters degree in marine biology, said her work in the Institute's library allowed her to combine her two interests of information science and marine biology.

"The JLB Smith Institute of Ichthyology Library holds the largest collection of literature on fish-related subjects in the southern hemisphere and is South Africa's national fish library. The publication of our data base on CD enables us to extend our library's service to all parts of the world. It maximises the return on our investment, in terms of information and education," she said.

More information about a subscription to the CD **Fish & Fisheries Worldwide** may be obtained from Mrs Margaret Crampton, Fishlit Information Service, JLB Smith Institute of Ichthyology, Private Bag 1015, Grahamstown 6140. Telephone (0461) 27124. Her Internet address is: ihmc@hippo.ru.ac.za

MODEL RURAL WATER PROJECT IS OFFICIALLY OPENED

The R410 000 KwaNyuswa water project under construction. Chiefly funded by the Port Natal-Ebhodwe Joint Services Board, the project is viewed as a model rural water scheme and will supply potable water to close to 2 000 members of the community.

The KwaNyuswa water project in the Ndwedwe district north-west of Verulam in Natal, which is viewed as a model rural water scheme using appropriate technology, was officially opened on 18 September 1993.

This R419 000 self-help project was chiefly funded by the Port Natal-Ebhodwe Joint Services Board (JSB) with donations from a number of private sector companies and R9 000 raised by the community. It was initiated and managed by the community with technical guidance from the CSIR's Water Technology Division and assistance from the KwaZulu departments of health and agriculture.

The new scheme supplies almost 2 000 people with potable water through yard taps. Previously, Kwanyuswa residents were reliant on water from springs and streams, many which have dried up during the drought.

The water scheme consists of a weir, a pump station, a purification plant and six reservoirs as well as spring protection and the laying of 40 km of piping, feeding 245 standpipes. Labour-intensive techniques were used throughout the year-long project using members of the community and creating jobs for 20 unemployed residents.

"Three community members were trained at the Valley Trust in ferro-cement tank building and numerous other construction skills were assimilated by other residents during the course of the project," said Mr Jurie Zagt, JSB chief executive officer.

The operation and maintenance of the scheme is self-financing. Participation is voluntary with each homestead paying R8 per month towards running costs. A maintenance officer and a pump house minder are employed permanently by the water committee.

The seeds for the KwaNyuswa water scheme were sown at a community meeting held in August 1990 when a water committee was elected. Each family who wished to participate then paid R40 towards the capital cost of the scheme to get it off the ground. This also instilled a sense of ownership and attracted outside donors. The committee then approached the CSIR through the KwaZulu Department of Health to do a feasibility study.

"It was this strong commitment and financial contribution from the community, together with the thorough feasibility study conducted by the CSIR which ensured JSB funding," Mr Zagt said.

The Port Natal-Ebhodwe Joint Services Board (JSB) has since granted R4,8 million to a further three water projects in the Ndwedwe district and a total of over R100 million to rural water schemes throughout the JSB's service area.

CAISSSON SYSTEM CAPTURES GROUND WATER

A novel caisson system for capturing underground water for human consumption is eliciting a great deal of interest among municipalities in the Cape Province.

Pioneers of the method are the municipalities of Albertina and Garies, both of which have had the caisson water capturing system in operation for several years. Recently Niewoudtville municipality also moved to installing the system while it is under consideration by Hondeklipbaai and Mosselbaai local authorities.

According to JVV Neveling, principal engineer of ground utilisation co-ordination of the Cape Provincial Administration, construction of a caisson system such as those at Albertina and Garies commences with the sinking of a well-like structure to below ground-water level. The well is lined using 1 mm diameter rings each with a height of 300 mm. This shell is then lined with a double geotextile layer. An appropriate diameter pipe is then placed vertically in the shaft and encapsuled in a selected stone filter material, to keep the geotextile in place and secure the pipe.

ARMS

The other vital components of a caisson system, Mr Neveling says, are water capturing arms radiating out from the well. Their type and nature may vary in accordance with each particular application. However, what is generally involved is the excavation of as many trenches as required commencing alongside the well at water table level and radiating out from the well in a spoke-type formation. Within this trench, which should be excavated to a gradient of 1:200, 100 mm Santar pipes are placed with their holes facing upwards. The pipes are encompassed in a gravel or stone mix and encapsulated in a geotextile "pipe". A suitable sandy layer is placed above this "pipe" and the remainder of the trench is filled with in situ soil.

SANTAR PIPES

Mr Neveling says that it is particularly important for the Santar pipes to be laid with their holes facing upwards in order to prevent any possibility of exfiltration. The spoke-like pipe-based collecters, which are normally 30 to 60 m long, act as water transporters feeding the water into the well from which it can then be pumped.

COST

Mr Neveling says the cost of establishing the entire structure is about R8 000. Thereafter, should enough water be captured, a pump could be installed at a cost of a further R7 000. This total cost had to be compared to that of sinking and equipping a borehole which, typically, could run to R100 000 or more.

The method, he says, has been found to be particularly suitable in very dry areas with low rainfall and where very little other natural water resources exist.

"It is an extremely versatile system. At Garies it has been built in the middle of a dry river bed. The collector drains have been placed across the river bed to intercept the flow of underground water. This more than trebled the output of the old well.

"In terms of water volumes, the well at Albertina initially delivered approximately 10 000 ℓ/h and has now settled to between 6 000 and 8 000 ℓ/h depending on drought conditions and occasional blocking of the geotextile. A back washing procedure clears the blockage and in bad conditions requires quarterly back washing."

MALAMULELE WATER WORKS EXPANDED

The capacity of the Malamulele water works on the Levubu River in Gazankulu has been expanded by almost hundred per cent. The upgrading will ensure that the water works is able to provide a regular supply of water to a number of communities recently connected to the Malamulele water grid.

Mr Basie Bouwer of consultants, Wates, Meiring & Barnard, said the previous capacity of the Malamulele works was 93 ℓ/sec. This had now been expanded to 180 ℓ/sec.

The extension work, he added, involved the addition of a flocculation channel, the building of three new clarifiers, the installation of three new filters and the construction of a new filter building. The clean water pump station was also expanded and a new electrical sub-station established. The project also involved the upgrading of existing facilities.

Mr Bouwer said an important feature of the project related to savings on the installation of about 3 km of pipe.

"From the Malamulele water works, water is pumped along a single pipeline to storage reservoirs situated in the town of Malamulele, some 7,5 km away. From there the water gravitates either to Mhinga or along another supply line which eventually branches off to other destinations. The expanded output from the Malamulele water works would have required the installation of a second 7,5 km pipeline to the Malamulele storage reservoirs.

"In order to save on this heavy pipeline installation cost we decided to feed the additional water from the works directly to the Mhinga pipeline. This enabled us to reduce the length of the new pipeline to 4,5 km, representing a considerable saving in capital and operational costs. By adopting this solution we were also able to avoid the costs of having to expand reservoir facilities at Malamulele. Instead, additional storage facilities will be established at Mhinga.

He said investigations were currently under way to ensure a regular all year supply of raw water from the Malamulele water works.

"Because of silting of the Levubu River the maintenance of a regular supply has been a problem in the past. In times of drought this has led to rural communities having to sink boreholes to augment their water supplies."

SA WATERKALENDER

The Water Research Commission is placing this calendar in order to assist with the co-ordinating of water events in South Africa.

You are invited to send information about conferences, symposia or workshops to the SA Waterbulletin.

Address:
The Editor,
SA Waterbulletin,
P.O. Box 824,
0001 Pretoria
Tel (012) 330-0340
Fax (012) 331-2565

Legend:

- ○ An SA Water Event arranged for these dates.
- □ 2nd SA Water Event scheduled for these dates.
- ✗ 3rd SA Water Event scheduled for these dates.

See conferences and symposia pages for events.

Die Waternavorsingskommissie plaas hierdie kalender om te help met die koördinering van watergebeurtenisse in Suid-Afrika.

Alle belanghebbendes word uitgenooi om inligting aan SA Waterbulletin te stuur.

Adres:
Die Redakteur
Posbus 824
0001 Pretoria
Tel: (012) 330-0340
Faks: (012) 331-2565

Gids:

- ○ Een SA Watergeleentheid vir hierdie dae.
- □ 'n Tweede SA Watergeleentheid gereël vir dié datums.
- ✗ 'n Derde SA Watergeleentheid gereël vir dié datums.

Sien Konferensies- en Simposiumbladsy vir aangeduide geleenthede.

1993

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SOUTHERN AFRICA 1993

WATER CARE

NOVEMBER 1993
Three short courses on water care will be presented at the Faculty of Natural Sciences, Technicon Pretoria. For more details, see announcement on page 2 of this Bulletin.

MICROBIOLOGY

NOVEMBER 1993/JANUARY 1994
An introductory course in water microbiology will be held at the CSIR. See advertisement on page 30 in this Bulletin.

1994

ANAEROBIC DIGESTION

JANUARY 1994 23 - 27
The seventh international symposium on anaerobic digestion will be held in Cape Town.
Enquiries: Symposium Secretariat, IAWQ: AD-94, PO Box 3123, Tygerpark 7536 SA.

BESPROEIING

MAART 9 - 11
Die tweejaarlikse kongres van die Suid-Afrikaanse Besproeiingsinstituut (SABI) sal by die ESKOM konferensiesentrum in Midrand naby Johannesburg gehou word.
Navrae: Die Sekretaris, SABI, Privaatsak X515, Silverton 0127. Tel (012) 804 1540 Faks (012) 804 0753.

DISINFECTION

MARCH 13 - 18
An international conference on disinfection of potable water will be held in the Kruger National Park.
Enquiries: Miss Louise Fourie, Conference Secretariat, Rand Water Board, PO Box 1127, Johannesburg 2000. Tel (011) 682-0472. Fax (011) 682-0444.

WATER & VOEDSEL

MAART 21 - 22
Die 8ste jaarlikse voedselwetenskapsimposium met die tema "Food Science in Africa" word in die Wes-Kaap by die Lord Charles Hotel, Somerset-Wes, gehou.
Navrae: Professor G van Noort Tel (02231) 74-506 Faks (02231) 833-737.

WATER TECHNOLOGY

JUNE 6 - 9
The 1994 international African water technology exhibition and conference, Afriwater, will be held at the National Exhibition Centre, Johannesburg.
Enquiries: Natalie Sanders, McNaughton Victor CC, PO Box 31368, Braamfontein 2017. Tel (011) 643-4824/8 Fax (011) 642-9860.

WATER ENGINEERING

JULY 14 - 15
A symposium entitled "50 years of water engineering in South Africa (a tribute to Prof Des Midgley)" will be held at the University of the Witwatersrand, Johannesburg.
Enquiries: Ms C Bernard, c/o Dr SJ van Vuuren, BKS Inc, PO Box 3173, Pretoria 0001. Tel (012) 209911 Fax (012) 20 9220.

CORROSION CONTROL

AUGUST 29 - 31
The sixth international corrosion conference entitled "Cost effective corrosion control into the 21st century" will be held at the Elangeni Hotel in Durban. CALL FOR PAPERS.
Enquiries: SA Corrosion Institute, PO Box 77, WITS 2050. Tel (011) 802-5145 Fax: (011) 804-3484.

WASTECON '94

SEPTEMBER 27 - 29
A conference on waste management will be held in Somerset West, Western Cape.
Enquiries: WASTECON '94, PO Box 1303, Cape Town 8000. Tel (021) 400 2423 Fax (021) 25 3848.

ICOLD

NOVEMBER 1 - 5
The 62nd executive meeting of ICOLD will be held at the Elangeni Hotel in Durban.
Enquiries: Mrs Ginny Eslick, ICOLD 1994 Organising Committee, PO Stamford Hill, 4051 Durban. Tel (031) 83 1984
Fax (031) 83 1984

ICOLD

NOVEMBER 6 - 11
The 18th ICOLD congress will be held at the Durban Exhibition and Conference Centre.
Enquiries: Mrs Ginny Eslick, ICOLD 1994 Organising Committee, PO Stamford Hill, 4051 Durban. Tel (031) 83 1984 Fax (031) 83 1984.

ANALYTICA '94

DECEMBER
The second national symposium on analytical science will be held early in December 1994 in the Western Cape. Theme: "Toward the Welfare of Man and his Environment".
Enquiries: Dr IM Moodie, ANALYTICA '94, c/o PO Box 19070, Tygerberg 7505. Fax (021) 932-4575.

1995

RIVER MANAGEMENT

MAY 14 - 19 1995
The IAWQ conference on river basin management will be held in the Kruger National Park.
Enquiries: Dr Ben van Vliet, Watertech, CSIR. Tel (012) 841-2237 Fax (012) 841-4785.
IWSA

SEPTEMBER 11 - 15

The biennial congress of IWSA will be held in Durban.
Enquiries: Mrs E Nupen, SA National Committee: IWSA, DWT< CSIR, PO Box 395, Pretoria 0001

OVERSEAS 1994

BROMATES

NOVEMBER 22 - 23
A workshop with the theme Bromates and Water Treatment will be held in Paris, France.
Enquiries: Mrs Janine Lindenbaum, Compagnie Generale des Eaux, 52 rue d'Anjou, 75384 Paris Cedex 08 (France). Fax: (33 1) 49 24 69 38.

RIVERS

DECEMBER 5 - 8
An international congress on metropolitan areas and rivers will be held in Rome, Italy.
Enquiries: Spett. le, Organising Secretariat, "Metropolitan Areas & Rivers", Studio EGA srl, Viale Tiziano 19, 00196 Roma.

MODELLING

DECEMBER 6 - 10
An international congress with the theme "Modelling change in environmental and socio-economic systems" will be held in Perth, Australia.
Enquiries: Professor Michael McAleer, Department of Economics, University of Western Australia, Nedlands WA 6009, Australia. Tel (61) 9 380 3400 Fax (61) 9 380 1016.
1994

HYDROLOGY

Commencing Semester: 1 February 1994
The joint universities' masters program in hydrology and water resources will be held in Adelaide, South Australia.
Enquiries: Project Administrator, The Flinders University of South Australia, FPO Box 2100, Adelaide, South Australia 5001. Tel: (61-8) 2012650. Fax: (61-8) 2012676.

WATER IN AFRICA

FEBRUARY 1 - 4 1994
An international conference on the efficient utilisation & management of water resources in Africa will be held in Khartoum, Sudan. Call for papers.
Enquiries: Dr Gamal M Abdo, Faculty of Engineering and Architecture, University of Khartoum, PO Box 321 Khartoum, Sudan. Tel 011 75931 Fax 249 11 44898.

AQUIFERS

APRIL 11 - 15
An international symposium on transport and reactive processes in aquifers will be held at ETH Zürich, Switzerland.
Enquiries: Symposium Secretariat, IAHR Symposium, c/o Institute of Hydromechanics and Water Resources Management, EJH Hönggerberg, CH-8093 Zürich, Switzerland. Tel (01) 377 3065 Fax (01) 371 2283.

SLUDGE

APRIL 12 - 15
A European conference on sludge and organic waste will be held at the University of Leeds, England. CALL FOR PAPERS.
Enquiries: Mrs Zena Hickinson, Course Secretary, Dept of Civil Engineering, University of Leeds, Leeds LS 9JT. Tel (0532) 347158 Fax (0532) 332265.

MEMBRANES

APRIL 26 - 28
A conference with the theme:

"Engineering of membrane processes 2" will be held in Tuscany, Italy.
Enquiries: Kay Russell, Elsevier Advanced Technology, Mayfield House, 256 Banbury Road, Oxford OX2 7DH, United Kingdom.

WATER SUPPLY

MAY 15 - 20
An IWSA regional conference entitled Water Supply 2000 "Rehabilitation" will be held in Zürich, Switzerland.

Enquiries: Zürich Water Supply, Hardhof 9, PO Box CH-8023 Zürich. Tel (*1) 435 2111 Fax (*1) 435 2557.

GROUNDWATER

MAY 23 -25
The 8th National Groundwater outdoor action conference and exposition will be held in Minneapolis, Minnesota, USA.
Enquiries: National Groundwater Ass. PO Box 182039, Dept. #017, Columbus, OH 43218-2039, USA. Tel (800) 551-7379 or (614) 761-1711 Fax (614) 761-3446.

GROUNDWATER

JUNE 13 - 16 1994
An international conference on future groundwater resources at risk will be held in Helsinki, Finland.

CALL FOR PAPERS.

Enquiries: Ms Tuulikki Suokko, FGR 94, National Board of Waters and the Environment, PO Box 250, SF-00101 Helsinki, Finland. Fax: +358 0 4028 345.

IAWQ

JULY 24 - 30 1994
The 17th biennial conference and exhibition of the International Association on Water Quality (formerly the IAWPRC) will be held in Budapest, Hungary.
Enquiries: IAWQ, 1 Queen Anne's Gate, London SW1H 9BT England. Tel: +44 (0) 71-222 3848. Fax: +44 (0) 71-233 1197.

MEMBRANES

AUGUST 29 - SEPTEMBER 2
The 7th international symposium on synthetic membranes in science and industry will be held in Tübingen, Germany.
Enquiries: DECHEMA e.V. Exhibitions and Congresses, Theodor-Heuss-Allee 25, PO Box 150104, D-6000 Frankfurt am Main 15.
Tel (069) 7564-241/242/243
Fax (069) 75 64-201.

MINE WATER

SEPTEMBER 19 - 24
The 5th international mine water congress will be held in Nottingham, UK. Theme: Mine water and the environment.
Call for papers.
Enquiries: The Secretary, IMWA Conference, c/o Department of Mineral Resources Engineering, University of Nottingham, University Park, Nottingham NG7 2RD, United Kingdom.
Tel (0602) 514076
Fax (0602) 678494.

ENVIRONMENTAL CONTAMINATION

SEPTEMBER 20 - 23
The second international symposium and exhibition on environmental contamination in Central and Eastern Europe will be held in Budapest, Hungary.

Enquiries: Roy C. Herndon, Symposium Co-Chairman, Florida State University/ CHAERSE, 2035 East Paul Dirac Drive, 226 HMB, Tallahassee, Florida 32310-3700, USA
Tel (904) 644-5524
Fax (904) 574-6704. E-Mail: buda94@chaerse.fsu.edu

DESALINATION

DECEMBER 1 - 2
An international conference on desalination and water reuse will be held at Murdoch University, Perth, Western Australia.

CALL FOR PAPERS.

Enquiries: Dr K Mathew, Remote Area Developments Group, Institute for Environmental Science, Murdoch University, Murdoch WA 6150, Western Australia.
Tel: 61-9-332 2896
Fax: 61-9-310 4997.

INTRODUCTORY COURSE IN WATER MICROBIOLOGY

organised by

Health Programme Division of Water Technology • CSIR • Pretoria

16 – 19 November 1993 • 25 – 28 January 1994

PURPOSE:

The purpose of this course is to provide a practical approach where participants will be trained in the basic concepts of health related water microbiology. The course will include practical (60%) and theoretical (40%) aspects.

WHO SHOULD ATTEND:

The course is aimed at people working in the water industry who require knowledge about basic techniques for the microbiological analysis of water. Industry, municipalities, government departments, water boards are among the bodies who may find such a course useful.

ATTENDANTS:

A maximum number of 12 attendants will be allowed to ensure personal attention.

COURSE DURATION:

The course will run over a period of four days, from Tuesday 25 to Friday 28 January 1994.

COURSE CONTENTS:

Attendants will be trained in the basics of water microbiology.

- Detection and analyses of faecal indicators of pollution (Standard plate count; Total coliform; Faecal coliform; Faecal streptococci/Enterococci; Coliphage and the confirmation of Escherichia coli).
- Interpretation and reporting of results.
- Demonstrations on the detection of other pathogens in water (Viruses; Parasites; Legionella; Bio-assays for toxicity and Ames mutagenicity test).
- Quality Control.
- Laboratory Safety.

COST:

R1 200 per person. Morning tea, lunch and afternoon tea will be included.

ACCOMMODATION:

Accommodation as well as the travelling to and from the CSIR are not included in the price.

CONTACT PERSON:

Mr Gerrit Idema • Health Programme Division of Water Technology • CSIR
PO Box 395 • Pretoria • 0001
Tel (012) 8413948 • Fax (01[illegible]4785

NOTE:

A detailed programme will be sent on request.

A minimum of six participants is required for the course to be presented.

SABI

SUID-AFRIKAANSE BESPROEIINGSINSTITUUT

Tweejaarlikse Kongres

Besproeiingsgeleenthede in 'n veranderende Suid-Afrika

9 - 11 MAART 1994

ESKOM KONFERENSIESENTRUM MIDRAND, JOHANNESBURG

Die Suid-Afrikaanse Besproeiingsinstituut (SABI) wil graag 'n geleentheid skep vir belangstellendes om die moontlikhede van groter besproeiingsbetrokkenheid in Afrikalande te ondersoek – 'n kontinent waar daar tans 'n dringende behoefte aan ontwikkeling en ekonomiese selfstandigheid bestaan.

Faktore wat suksesvolle besproeiingsontwikkeling in opkomende gemeenskappe beïnvloed, sal tydens die konferensie bespreek word in die lig van veranderende ekonomiese en politieke omstandighede, met ondersteuning van kundigheid uit die ontwikkelende wêreld.

Aandag sal geskenk word aan die vereistes waaraan geskikte tegnologie in Afrika moet voldoen asook aan die bestuur van projekte wat wissel van grootskaalse besproeiingskemas tot bestaansboerderye op gemeenskapspersele.

Die SABI-kongres sal in besonder aandag skenk aan:

- ❑ Logistiek, infrastruktuur en potensiaal in Afrikalande.
- ❑ Ontwikkelingsbefondsing en finansieringsreëlings.
- ❑ Die beskikbaarheid van navorsing en ontwerp–ondervinding vir besproeiingsontwikkeling in en om Suid-Afrika.
- ❑ Die beskikbaarheid van besproeiingstoerusting en die rol wat SABI kan vervul in die bevordering van invoere en uitvoere.

Die doelwitte van die simposium sal bereik deur o.a.:

- ❑ Hoofredes en referate deur kundiges uit 'n aantal Afrikastate.
- ❑ Werkgroepsessies vir afgevaardigdes waartydens moontlike oplossings vir tipiese probleme ontwikkel sal word.
- ❑ Ruim geleentheid vir informele gesprekke tussen afgevaardigdes rondom uitstallings en tydens teetye en middagetes.

Vir meer inligting kontak:

Die Sekretaris, SABI, Privaatsak X515, Silverton 0127.

Seventh International Symposium

on

ANAEROBIC DIGESTION

23 - 27 January 1994

CAPE TOWN

IAWQ

For information or registration enquiries please contact:

Symposium Secretariat
IAWQ: AD-94
PO Box 3123
TYGERPARK
7536
South Africa

Contact person: Dr Bill Ross

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International Fax: +27 - 21 - 994707